DOCUMENT RESUME

ED 171 600 SO 011 614

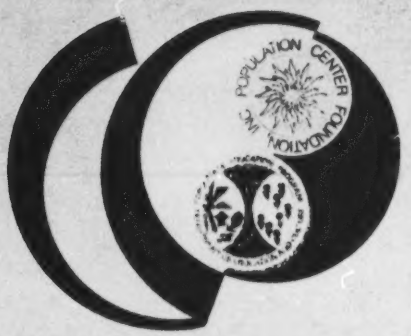
AUTHOR	Arellano-Reyes, Ma. Felicitas; Villanueva, Carmelita L.
TITLE	On the Effectiveness of the Discovery Approach as a Teaching Method for Population Education. Population Education Research Utilization Monograph Series Number 1, Part 2.
INSTITUTION	Population Center Foundation, Rizal (Philippines). Information and Research Utilization Div.
PUB DATE	May 76
NOTE	65p.; For related documents, see SO 011 613-620; Photographs and light print type may not reproduce clearly in paper copy
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Comparative Education; Critical Thinking; Curriculum Development; *Discovery Learning; Educational Strategies; *Effective Teaching; Elementary Secondary Education; Foreign Countries; Integrated Curriculum; *Population Education; *Questioning Techniques; Relationship; Skill Development; Student Attitudes; Student Characteristics; *Success Factors; Teacher Characteristics; Teaching Methods
IDENTIFIERS	*Philippines; Population Education Program

ABSTRACT

Research is reviewed on the effectiveness of the discovery approach in teaching population education at the elementary and secondary levels. The discovery approach is a key teaching strategy in curriculum developed by the Filipino Population Education Program (PEP). PEP curricula cover the following content areas: demography, determinants and consequences of population growth, sexuality and human reproduction, and family planning. Among the research findings are that the discovery approach is more effective than traditional expository teaching methods in 1) bringing about learning, retention, and transfer; 2) stimulating critical thinking; and 3) developing positive attitudes toward teachers and subject matter. Effectiveness of the discovery approach depends to some extent on teacher and student competence, administrative support, and compatibility of teaching methods in the units into which discovery-approach population education materials are integrated. Suggestions are given for achieving maximum effectiveness in areas of teacher competence, flexibility of time, administrative support, and integration of curriculum. The report concludes with 19 abstracts of research papers and monographs on the use and effectiveness of the discovery approach. (AV)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED171600



U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
M. Reyes
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Population Education Research Utilization
Monograph Series 1 Part 2
May 1976

ON THE EFFECTIVENESS OF THE DISCOVERY APPROACH AS A TEACHING METHOD FOR POPULATION EDUCATION

CARMELITA L. VILLANUEVA
Population Education
Research Utilization Project

Population Information Division
Population Center Foundation
Makati, Rizal, Philippines
1976

Edited by Generoso J. Gil, Jr., former Director, Population Information Division, Population Center Foundation

SP 011 614

Population Education Research
Utilization Monograph Series
Number 1 Part 2 May 1976

AUTHORS OF THIS NUMBER
Ma. Felicitas Arellano-Reyes
Carmelita L. Villanueva

EDITORIAL CONSULTANTS
Rosario Alberto, Ph.D. Educational Administration, University of Washington
Jose Arong, Ph.D. Education, Stanford University
Leonardo de la Cruz, Ph.D. Education, Stanford University
Thomas Dohm, Ph.D. Candidate in Psychometric Methods and Differential Psychology
Generoso J. Gil, Jr., Doctoral Fellow, Stanford University and East-West Center
Manolo B. Jara, Executive Editor, DEPTHnews
Vicente G. Tirol, Editor of Publications, Population Information Division, Population Center Foundation

Produced in the Philippines by the Information and Research Utilization Division, Population Center Foundation.
Jose Luis Ledesma, Director

Copyright Free 1976
by the Population Center Foundation
Philippines

Contents

Introduction v

The Population Education vii

The Research Utilization Program xi

On the Effectiveness of the Discovery Approach as a Teaching Method For Population Education.
Preface 15

I. Issues in Curriculum Development 17

II. The Discovery Approach 21

III. Effectiveness of tne Discovery Approach: What the Research Says 24

IV. Other Variables 43

Summary 51

Abstracts 57

INTRODUCTION

This research monograph is one of the final outputs of the Population Education Research Utilization Project of the Population Information Division (PID) of the Population Center Foundation. The PID pilot-tested the concept of research utilization in cooperation with the Population Education Program (PEP) of the Department of Education and Culture to achieve these objectives:

1. To facilitate the flow of information between and among professionals at different implementation and decision-making levels in the population field;
2. To maximize the application of research results and scientific knowledge to policy planning and professional practice;
3. To gather experiential feedback from the field to help frame future policy and research.

To meet these objectives, research utilization started with a preliminary investigation of *a priori* and *emergent* problems in the field of population education curriculum development through interviews with selected key staff members of the PEP and some classroom teachers. The output of the interviews determined the necessary direction for the literature search and topics for the literature reviews. This also provided the occasion for the systematic collection of pertinent research done in the Philippines and in foreign countries. These research findings, theories and alternative models culled from research studies done here and abroad were reviewed, translated and rewritten into readable, understandable and relevant form for practitioners, administrators, policy planners and researchers in population education.

Thus, revolving around the theme "Appropriate Contents and Strategies for Curriculum Development in Population Education," three papers were written out of the literature search:

1. "Case Studies of Philippine Experience in Population Education Curriculum Development;"
2. "On the Effectiveness of the Discovery Approach as a Teaching Method for Population Education;"
3. "Problems in Introducing Human Sexuality in the Population Education Curriculum."

These papers served as the springboard for discussions in three conferences held in April, May and June 1975 to elicit the reactions and experiential feedback from four levels of population education professionals: practitioners, administrators, policy planners and researchers.

The first conference was attended by a nationwide sample of 26 teachers representing the five subject areas into which population education is integrated. They reacted to the literature reviews by comparing and testing research results against their own experiences in the field and on the applicability of these general propositions to the teachers' actual working situation. What followed were program suggestions based on these empirical propositions.

In the second conference, 19 supervisors from all over the country were asked to react to the literature reviews and to the teachers' reactions in the context of the program, organization and administrative implications.

The third conference was attended by 30 policy planners and researchers from the PEP, the Department of Education and Culture and other population-related agencies. They were asked to react to the literature reviews and to the reactions of the teachers and supervisors; they identified priority research problems and formulated policy statements which have implications on the nation's population education policy, on evaluation of the PEP program, on the types of materials that should be developed to successfully implement the national program, and on linkage with other national programs and agencies.

Based on the original literature reviews and the consolidated teachers' reactions and recommendations, the supervisors, policy planners and researchers have evolved the basic content of the research monographs. Thus, this research monograph is a more extensive and refined version of the original literature review. It has been organized into a set of empirically-based propositions, duly guided and qualified by reactions and feedback from the four levels of program professionals who participated in the series of conferences.

In this monograph, the empirically-based propositions or issues culled from research done here and abroad are presented first. Then each issue or proposition is further tested against the participants' own experiences in the field by agreement, disagreement, or doubt. Lastly, their recommendations are presented to answer the issues and the questions raised. In summary, all their reactions, comments and recommendations are interwoven with the larger issues or propositions contained throughout the literature review. Apart from this, the abstracts of all the research literature cited and reviewed are appended.

The Population Education Program

Population education was introduced in the Philippines in an attempt to involve the schools in the solution of the country's population problems. The reason is simply this: the young who are the parents of tomorrow have largely been ignored and neglected by family planning activities in favor of married couples who want to limit or space their children. Population education then is a long-term measure designed to develop attitudes and rational behavior among the people toward a small family. This is not an easy task. It requires a lifetime process and a dynamic force to change attitudes and values which have been deeply rooted in culture and tradition. And this is where the school as the nation's foremost educative agency can take an active role. By including population studies in the curriculum, it is hoped that the children and the youth will develop the knowledge, attitudes, skills and the understanding needed to make rational responsible decisions regarding their behavior toward fertility and other population matters.

To achieve this end, the Population Education Program (PEP) of the Department of Education and Culture was organized to undertake a systematic and deliberate effort to involve schools in the population education of individuals. To give the program a clearer framework and direction, population education has been officially defined as "the process of developing awareness and understanding of population situations as well as a rational attitude and behavior toward those situations for the attainment of quality life for the individual, the family, the community, the nation and the world."

The program has developed a set of population education curricula to help the student appreciate the consequences of population dynamics in his immediate and remote environment and the implications of rapid population growth.

The curricula over the following content areas: demography, determinants and consequences of population growth, sexuality and human reproduction, family planning and planning for the future.

Considering the importance of educating the young in the facts of population change, population education is introduced in all levels from Grade I and high school to college, specifically the teacher-training institutions and in the arts and science courses. Population concepts are introduced through unit integration or permeation into five mother subjects in both elementary and secondary schools – Social Studies, Science, Health, Home Economics and Mathematics.

History

Population education efforts started even before the establishment of PEP. One of the country's pioneering efforts in this field was undertaken way back in 1970 by the Bureau of Public Schools. In fact, two of the existing population education strategies now being implemented were drawn up by the BPS during its first workshop on population curriculum development in 1970. These are: (a) introduction of population education from Grade I to fourth year high school; and (b) integration of population education concepts into the existing units in Science, Health, Social Studies and Home Economics. To help implement these strategies, the first BPS workshop produced a compilation of different teaching units for elementary and secondary levels and population education concepts related to different existing units in the mother subjects.

Almost simultaneously, two private educational institutions also started their own population education programs: the Population Education Center of Philippine Women's University and the Philippine Wesleyan College.

The PEC/PWU program aimed to develop materials and acquaint teachers and students in both public and private schools with concepts and values on responsible family living. Special emphasis was given on the relationship of family size to the country's social and economic problems. Out of this project evolved materials for Grade 6, first, third and fourth years of high school.

On the other hand, the Philippine Wesleyan College's population education program stemmed from the community outreach program of its medical department which carried out family planning activities. This program consisted mainly of curriculum development for elementary, secondary and college levels.

The establishment of other institutions separately engaged in introducing population education in the schools led the Department of Education to organize PEP in 1972 as a coordinating agency for population activities in the Department. The Program was established with the assistance of the United Naions Fund for Population Activities (UNFPA) and the United Nations Development Program (UNDP).

Through the integration of population education in the curricula of all levels of the formal school system, the following long-range objectives may be accomplished:

1. That the Philippine family size norm will be reduced;
2. That decisions made by Filipinos on population matters in both the personal and social levels will be more responsible;
3. That the education program provided to students will be more relevant to their felt needs.

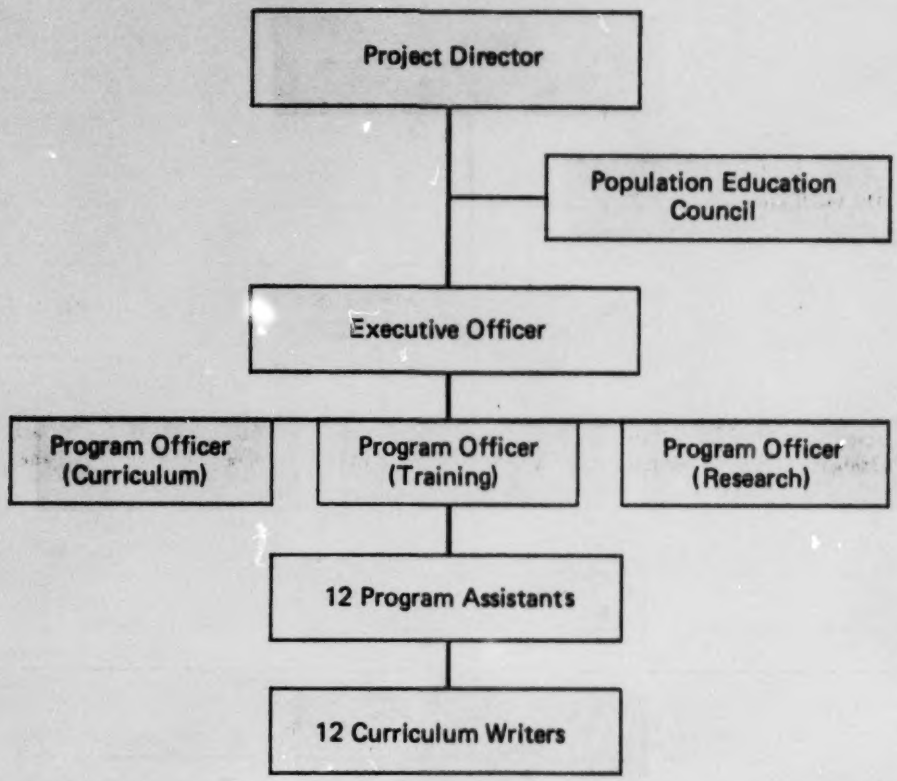
Its specific objectives are:

1. To provide instruction on population education to students of the three target levels by training 186,000 elementary teachers; 15,600 secondary teachers; and 360 teaching-training instructors in the country to implement the designed courses;
2. To develop curriculum materials for the population education content in all levels;
3. To provide necessary basis for more definite curricular changes in the formal school system in terms of content of approved textbooks, official syllabi and other instructional materials for use in the elementary and secondary courses and in the pre-service and in-service education of teachers.

Organizational Set-Up

The PEP is directly under the Department of Education with UNESCO as the executing agency. The Secretary of Education serves as Project Director in a concurrent capacity, assisted by an Executive Officer, three Program Officers, 12 Program Assistants and an administrative staff. An advisory board, the Population Education Council, has been established to

Organization of the Population Education Program



insure coordination among other agencies involved in population education and related population activities.

As shown by the Program's organizational structure, there are three main functions or components – curriculum development, training and research.

A. Curriculum Development – This unit/component is responsible for developing curriculum materials in all educational levels.

In the elementary and high school levels, the unit has developed curriculum sub-units for particular grade levels and subject areas. The population content of the curriculum materials covers five main areas: demography or population growth, human sexuality and planning for the future. The manner of introducing population education is a combination of permeation and the unit method. Sub-units in population education have been inserted into existing units in the syllabi of Social Studies, Health, Science, Home Economics and Mathematics. These sub-units, which range from several days to one or two weeks, are designed to enrich the units that will accommodate them. To help teachers in teaching these sub-units, the unit has also developed *Teachers' Guides in Population Education* and a corresponding *Background Information for Teachers*. These curriculum materials have undergone three revisions.

At the teacher training institutions, a population education syllabus has been developed for a three-unit course, which is taught as a single elective course. This is in addition to a *Resource Book in Population Education for Teacher Education* for use of those who attended the pre-service teacher training.

For other colleges and universities, curriculum materials have been prepared for the teaching of population education in the arts and sciences as a separate subject, as an integrated course, and as a seminar course.

In addition, the unit has started translating into Pilipino elementary population education sub-units in Social Studies and Health; developed pupil materials on population education; and produced 30-minute TV programs in strategies used in teaching population education in the elementary and secondary levels.

B. Training – To ensure effective implementation of the program, the training component of PEP has prepared a five-year massive training program at three levels. The first consists of a five-week training course for 720 members of the elementary level supervisory training teams (STTs) who will eventually train teachers. The second consists of a one-week training to be conducted by the STTs who will train 65 per cent of the total elementary school teachers or 187,000 teachers and 20 per cent of the total 15,600 secondary school teachers. The third consists of a five-week training course for 360 teacher-training instructors who are expected to implement the designed courses in their schools.

The STTs' five-week training course aims to provide participants in-depth background knowledge in population and population education to be able to train teachers. The one-week teachers' training program is designed to equip them with the necessary knowledge, attitude and skills in integrating population education.

As of August 1975, the Program has conducted the last of both elementary and secondary STT programs, attended by 410 elementary and 29 secondary supervisors. These STTs, in turn, held one-week training programs for 54,264 elementary school teachers; re-oriented trainors from Region 7-11 in two seminar workshops; and held the third summer training for 215 college instructors. They also conducted orientation seminars for 250 division superintendents and regional directors in the national level, and another for 1,125 school heads and school superintendents at the regional level.

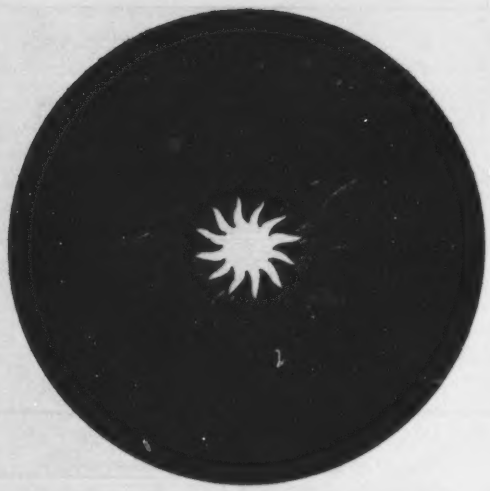
C. Research – The research program has two principal components. The first concerns the establishment of a requisite theoretical background (an empirical base); the second seeks to evaluate various aspects of program effectiveness and efficiency.

In the area of empirical or basic research, the Research Unit has conducted several studies to provide baseline data for curriculum development and population education program planning to suit the needs and interests of the target audiences. Among these studies are:

1. A regional study in cultural sociology-anthropology entitled "How Children Develop Concepts of Family Size;"
2. A survey of "Family Size Preferences Among Filipino Adolescents;"
3. A study of "The Fertility Behavior of Teacher Trainees" involved in training programs;
4. A study on the "Reactions of Parents, Teachers and Laymen and Other Segments of Society Towards Certain Potentially-Controversial Population Education Content;" and
5. "Survey on Students' Knowledge of and Attitude on Population Matters in Tarlac and Pangasinan."

In the evaluative-practical area, the Research Unit has conducted regular evaluation of the training programs, both on the national and local levels. Instruments for the evaluation and tryout of curriculum materials have been prepared to secure feedback on the sub-units as fast as they are prepared.

THE RESEARCH UTILIZATION PROGRAM



The Population Education Research Utilization project was designed and implemented to test and operationalize the the basic Population Information Division core program of research utilization strategy. The strategy aims to facilitate the flow of scientific and technical information between and among practitioners, administrators, policy planners and researchers in the population field in order to maximize the application of research results to policy and professional practice.

The PID developed the Research Utilization Program to counter factors that tend to limit the application of research findings and technical information to policy and professional practice. These main factors are:

1. *The flow of research results and other technical information from researchers to practitioners and policy planners is restricted by a number of bottlenecks.* Research results are seldom used by practitioners and policy planners because: (a) the results seldom reach them; (b) if they do, they are not read; (c) even if read, they are seldom intelligible; and (d) even if intelligible, they are seldom implemented because explanatory variables in very many studies are not under the control of the practitioners or policy makers.
2. *Problems of policy planners and practitioners are seldom the starting points of research.* Unless directly contracted, researchers seldom take the problems of policy planners and practitioners as the starting point for their studies for the following reasons:

   (a) To the extent that many problems simply stem from the lack of resources, research is unnecessary;

   (b) Even where new information is needed, the action agency's self-monitoring and information-gathering capabilities often suffice to retrieve or produce the information;

   (c) Where the action agency tries to get researchers interested in its problems, researchers may find the problem trivial or otherwise uninteresting.

3. *Research utilization has to be linked with decision-making and innovations;* The communication and dissemination of research results are seldom planned to encourage the adoption of innovative methods in policy and practice. Research utilization involves the acceptance of new ideas and practices. Thus, it has to take into account the decision-making structure of action agencies. The adoption of innovations calls not only for the diffusion of information but also a conscious decision to adopt such methods of individuals and organizations. For some innovations, decisions can be freely made by the adoption unit; for others, such decision is contingent on earlier enabling decisions done by someone in authority; for still others, these decisions are authority decisions that simply have to be obeyed. Also, adoption decisions may be individual or collective. Given that research utilization involves the adoption of innovations and that the latitude one has in adopting innovations depends on one's position in the authority structure, the Research Utilization Program has segmented the audience of population professionals into researchers, practitioners, administrators and policy planners in terms of their capacity to make adoption decisions.

The program encompasses four major functions: (a) *research transformation* – development of a policy-and practice-relevant state of-the-art summation of scientific findings based not only on a review of the literature, but also on the feedback of professionals in the population field; (b) *dissemination* – communication through print and electronic media of these scientific findings as well as case studies to sub-audiences of population professionals; (c) *information retrieval* – collection, indexing, and abstracting of research information – in print, film or microfilm – to be transformed or disseminated; and (d) *research* – implementation of research on the flow of scientific knowledge needed to implement the basic research utilization strategy; also, when the research transformation function warrants it, further analysis (secondary analysis) of research data collected by others.

The basic unit of the program is a 12-to-18-month *research utilization cycle,* covering information retrieval, research, research transformation and dissemination on a problem or cluster of interrelated problems felt by action agencies. The Information and Research Utilization Program will concentrate in four major content areas – biomedicine, information, education and communication, population education and the social sciences.

The research utilization strategy was first pilot-tested in the field of population education. This decision was made out of the full realization that population education is a relatively new field in the National Population Program. Because it is a new program, there is a great and urgent need for policy planners and administrators to seek "valid knowledge" from research and experience. This will help them identify their needs and their problems better, plan out more relevant projects, form innovative strategies and practices which will effectively involve the schools in the solution of the population problem.

Presently, the Population Education Program of the Department of Education and Culture is engaged in a continuous process of curriculum revision. Since this is a new field, PEP believes that it is imperative to continually alter the curriculum to reflect new ideas taken from research and observation on what should be taught and how it should be taught. Similarly, the same is being done with PEP's teacher training activities. The PEP is trying various alternative training models and strategies to determine which will be the most effective vehicle for delivering population education knowledge and teaching competencies to teachers in the field. Definitely, research findings and practical experiences of other agencies and individuals involved in teacher training can serve as valuable inputs into policy planning and practice.

In the other population fields, like social sciences, IEC, biomedicine, there is a proliferation of disciplines and agencies with disparate program implementation. This is not so in education. In fact, it is only one of the few programs, which has established a central body, the PEP to plan, implement and coordinate population education activities in the whole country. Thus, the PEP has the authority and direct control over the teaching of population education in all levels – elementary, secondary, teacher-training institutions and colleges and universities – both public and private. This

organizational structure makes for fast and centralized introduction of policies and decisions involving population education activities in all levels and sectors. Furthermore, the issuance of a Department Order or a memorandum from the Secretary of Department of Education and Culture can help facilitate and transmit these policies. Broadly speaking, the decision-making structure under which the population education program works provides a clear entry point for research utilization strategy.

Another good feature of the program, which lends itself to a research utilization strategy, is the distinctive delineation of the population education professionals into the four target audiences: practitioners, administrators, policy planners and researchers. These target audiences are mostly different from those in other population fields. These individuals, who compose a particular level of a target audience, belong to varied professions and have multiple or less identifiable functions. Such individuals can be found in IEC, or the social sciences. On the other hand, members of a particular level of a target audience of the population education program are more homogenous in roles and are easily identifiable. Examples are teachers for practitioners, principals and supervisors for administrators, superintendents and PEP key staff as policy planners. As such, the relatively simple organizational set-up for personnel and professionals facilitates the diffusion and application of innovation and research results in the field of population education.

ON THE EFFECTIVENESS OF THE DISCOVERY APPROACH AS A TEACHING METHOD FOR POPULATION EDUCATION

PREFACE

The use of the discovery approach poses many problems for population education teachers. Some are not quite sure what it is; others do not quite know how it fits within the larger picture of population education; others have doubts about its effectiveness; and still others are not confident about their own ability to use the discovery approach the way it should be used.

This research monograph has been prepared in an attempt to answer these questions, backed up by some research evidence and the reactions and recommendations of some selected teachers, supervisors, policy planners and researchers involved in the Philippine population education program. This paper also intends to set forth a framework within which these issues can be further discussed by other teachers, administrators and researchers comparing their own experience in the field of population education.

As a point of departure, then, this monograph starts with a rather brief, oversimplified review of the issues in curriculum development and then touches on the issues of course objectives and content. What are the objectives of population education? And, given these objectives, what course content has been developed to meet these objectives?

These two issues are touched upon only rather briefly. What is of major interest is the question of method: what teaching method – and learning activities – are most appropriate for the course objectives and for the course content of population education? The choice of the discovery approach is justified in terms of the course objective of developing in students the capability to make decisions about their present and future population-related behavior. And, the choice of the discovery approach is justified further in terms of the controversial nature of the content.

Then, this research monograph goes into some detail as to exactly what is the discovery approach. The fact is, the discovery approach is not one single monolithic approach. Population education policy planners unanimously agreed that discovery approach is an environment or

15

orientation of teaching and learning rather than a specific method. It should be viewed as a continuum of teaching alternatives with the traditional expository approach at one extreme and the unstructured discovery approach at the other. Broadly speaking, it refers to a set of teaching methods where the student exerts control over the learning process, with the teacher playing a facilitative role. Different discovery approaches vary in terms of whether the teacher's facilitative role is major or minor, whether the stress is on induction or deduction, etc. But the main thing is that the student is involved in hypothesizing relationships between phenomena, testing these hypotheses, modifying these hypotheses on the basis of evidence, and applying these hypotheses across a range of situations.

The question of whether the discovery approach is more effective than the traditional expository approach is then explored, but not before some of the difficulties in evaluating the research evidence are enumerated.

By and large, the research evidence suggests that the discovery approach is more effective than the traditional expository approach with regard to student learning, retention and transfer. Students taught by the discovery approach are more likely to be more critical in their thinking and to participate more in the classroom than those taught the traditional way. Also, students taught by the discovery approach are more likely to have favorable attitudes towards the teacher and towards the course content.

However, the effectiveness of the discovery approach seems to depend to some extent, at least, on what both students and teachers bring with them to the learning situation. The discovery approach seems more likely to benefit the brighter students than the slower ones. And, of course, the more competent the teacher – both in terms of knowledge of the subject matter as well as skill in teaching through discovery – the more likely the discovery approach is to be effective. And finally, there is the variable of time: the use of the discovery approach may involve more time than does the traditional expository approach.

In addition to these empirically based propositions, the teachers, supervisors, policy planners and researchers cited four other important conditions making for greater effectiveness of the discovery approach. These are: (a) the extent of administrators' support and quality and number of teaching aids available to the teacher; (b) integration of population education into the different subject matter areas making use of discovery approach and other teaching methods; (c) language barrier; and (d) the question of appropriateness of the discovery approach to the general culture of the Filipino.

All of the six empirically-based propositions were culled from research done here and abroad on subjects other than population education. There are, to our knowledge, no studies done locally on the effectiveness of the discovery approach with regard to population education. The additional four practical contributory factors that could qualify the effectiveness of the discovery approach were brought up by the teachers, supervisors, policy planners and researchers borne by their practical experiences in the field.

ISSUES IN CURRICULUM DEVELOPMENT

The process of curriculum development demands that three interrelated questions be answered:

1. What are the objectives of the course? What knowledge, attitudes, and skills do we want to develop, maintain, and/or modify in the student?
2. Given the course objectives, what content is appropriate for different grade levels and how should this content be organized? Having broken down the rather general course objectives into more specific objectives, what course content is most likely to achieve these specific objectives? What conceptual framework should be used to organize this course content? And, in teaching the course, which elements of the course content should be taught first, taught next, or taught last (sequencing)? And finally, what learning activities should be undertaken to best impart course content to the students?
3. Given the knowledge, attitudes and skills that both teachers and students bring to the learning situation as well as the structure and procedures of the institution in which learning takes place, what is the teaching method or set of teaching methods that is most likely to lead to an attainment of course objectives?

The Issue of Objectives

The Population Education Program (PEP) of the Department of Education and Culture has assumed the responsibility of developing a population education curriculum.

And the curriculum the program has developed is aimed at effectively conveying to students knowledge about, and sensitivity to population characteristics and the causes and consequences of population change. By conveying this knowledge and sensitivity, the program hopes to inculcate in students the capacity to make, now and in the future, responsible decisions related to population, particularly their own fertility behavior.[1] It is

further hoped that this sense of responsibility will be based on the norms and needs of society.

Based on these objectives, the PEP curriculum writers have gathered and produced a set of curriculum materials which, in their best judgment, meet the objectives. However, there have been, so far, no tight empirical studies evaluating this claim.

There are many questions which we can answer only with speculation. For instance:

1. How relevant and understandable to the students are the concepts we are trying to teach?
2. Are the materials organized in the right way, in the sense that the fundamentals are taught first and the other materials based on these fundamentals taught afterwards?
3. Are the proposed teaching methods the most appropriate for attaining the course objectives?
4. Are the proposed learning activities the most appropriate for attaining the course objectives?
5. Are the proposed learning methods appropriate for the proposed teaching methods?

One's initial reaction to these problems is, obviously: "Well, what are we waiting for? Let's go ahead and evaluate the program scientifically. Let's get some good answers and review the program on the basis of these scientific findings."

The problem isn't that simple.

In developing the population education curriculum, the curriculum writers have drawn on many different theories of learning and instruction – theories which are not necessarily consistent with one another. One theory may predict that rote learning is the most effective method for learning a language; another may predict that unstructured conversation is the best way. Or in very many instances, the curriculum writers themselves have not been explicit about the theories of learning and instruction they have used in the development of the curriculum.

Even if the curriculum writers have used different theories and have not been explicit about which theories they have used, it still is possible to evaluate whether students are learning anything or not. But this is not sufficient.

Without theory to serve as a framework, it becomes extremely difficult to state for certain why students are not learning and what should be done to help them learn.

Theory, after all, is nothing more but the framework that defines *which characteristics* of teachers, students, teaching materials and teaching institutions make for differences in student learning. Theory defines these characteristics as significant by suggesting *how* all these characteristics are related to one another and how they, singly and together, affect or are otherwise related to student performance. Finally, theory justifies these interrelationships by stating *why* these characteristics should be interrelated.

Hence, even if people were dissatisfied with the way students are learning about population, it would be very difficult to determine what should be done to remedy the situation, how it should be done, or why it should be done. The answers will vary, depending on what theoretical framework is used. Without any coherent theoretical framework, there is no clear standard by which answers to these policy questions may be evaluated as better or worse.

The Issue of Content

Even without going into the *how* and *why*, there are problems at the *what* level. The general objectives have been broken down into more specific objectives, but is this the right breakdown? The content blocks that have been developed are presumably those that will best achieve the specific objectives, but how valid is this presumption? For students at any given grade, the content has been written up in a form supposedly appropriate for their level, but how correct is this supposition?

To be sure, the curriculum developers have developed the content that, in their best

judgment, would be most likely to attain the population education program's objectives. They have been the first to recognize that a tight evaluation of their work has not been done and that it will be quite difficult to do so since they did not initially work from a very coherent theoretical framework.[2]

It is possible to evaluate whether students are in fact learning what the curriculum developers say they should be learning. It is quite another thing, however, to be able to justify recommendations as to what should be done, much less how it should be done, or why.

The Issue of Method

On course objectives, population education aims to enable the student to make, now and in the future, responsible decisions on his own population-related behavior. As regards the population education content, it is taken for granted that the subject matter is controversial.

These two facts are deeply interrelated: precisely because the subject matter is controversial, the objective of the course is to help the student make responsible decisions; and precisely because the course aims to help students make responsible decisions, its content has to be treated as if it were controversial, that is, as if there were good reasons for deciding one way or the other, as if every decision had both good and bad implications.

Given this objective and the controversial nature of the subject matter, it is obvious that the teaching method appropriate to population education *cannot* be one in which the teacher rather dictatorially tells students that *this* behavior is *the* right one and all others are wrong. Rather, the ideal teaching method should present and evaluate plausible alternatives in terms of the advantages and disadvantages associated with each. And on the basis of this evaluation, a given alternative is either accepted or rejected – with the clear understanding that the right decision for one may be the wrong decision for another.

Precisely because the subject matter is controversial, ethics demands a free choice, and that in the evaluation of alternatives, the information needed to make truly free choices is made available.[3] And precisely because the school, as an institution, aims to develop the students' intellectual capabilities, the standards for making free choices must be rational and intellectual. At the risk of oversimplification, then, population education aims to develop the type of student who can make rational and intellectual decisions about his population-related behavior in terms of how this behavior will affect him and the society of which he is part.

But this is easier said than done. It is a fact of life that we can never really have total information about everything. In fact, we often must make decisions without the full information at our fingertips. This implies that the student must somehow develop the willingness and the drive to seek information as well as the knowledge and skill necessary to determine what information is needed, and how to go about looking for it. After having found it, the student must know how to logically and rationally connect value with value, value with fact and fact with fact to come up with what, to him, is the best decision.

In short, what the population education program aims to develop is the type of student who can freely make responsible decisions, rather than one who will, automatically and unthinkingly, decide on a small family. The program thus is more interested in the *process* through which the student decides on his population-related behavior rather than in the product – the student's actual decision itself. In effect, the program aims to develop the type of student who can observe, describe, predict and understand what changes in the population mean: what is the effect on the family of having few or many children; what is the effect on society of having many more younger people than older people in the population; what effects the growth of population more – birth rates or death rates, etc.

Some teachers felt that although discovery approach is basically process-oriented, they suggested that the actual product or decision

itself should never be ignored or subordinated to the process of arriving at this decision. Thus, in science or mathematics which requires accurate and precise product, the students are left to discover their own strategies or process of arriving at the product as long as the solution is the precise answer. In this case, therefore, the teachers have the bigger responsibility of placing emphasis on the product. However, this is not true with controversial issues in social studies or home economics, like small family size, human sexuality and migration. Definitely these issues will require teachers to give more emphasis on the process rather than on the product or decision of the individual. It is assumed that whatever the product or decision the individual has arrived at, it was done through a rational and logical process. Because of this, social studies teachers and supervisors were emphatic that decision should be left entirely to the students.

The implication for the choice of teaching method for population education is obvious: it must be the type that stresses the analysis of the situation, the definition of problems, the search for solutions, the evaluation of alternative solutions and the choice of one of the alternatives. By and large, then, it is quite similar to the scientific approach of observing phenomena, raising questions about possible relationships among phenomena, making inferences, predictions, and hypotheses, and then deciding – on the basis of empirical test – which alternative hypotheses best explains the data.

It is not surprising, therefore, that in choosing the teaching method to use in population education, curriculum developers have settled on the so-called discovery approach. It is a method used for teaching science, particularly as it has been applied to the study of social problems in the social studies curriculum.[4]

In this regard, teachers, supervisors, policy planners and researchers in the population education field unanimously agreed: the discovery approach is the most effective method for teaching population education. It has been formally recognized and accepted that the method is particularly appropriate for developing the ability to make responsible decisions regarding population-related behavior – the basic goal of the population education program.

20

THE DISCOVERY APPROACH

One should not look for a hard and fast definition of discovery. Educationists themselves do not use the term consistently. "Discovery" has been used interchangeably with such terms as "problem-solving" (Gagne, 1965), "inquiry" (Massialas, 1970), intermediate discovery (Kersh, 1958), or independent learning/teaching (Craig, 1958). In evaluating the discovery approach, researchers have tested its effectiveness as a method of instruction, a mode of learning, or the logical process used in the development and verification of knowledge.

Basically, however, the discovery approach – whether it is used as a method of teaching or learning, or whether it is called by one name or another – is involved in one common process: it facilitates the discovery of meaningful concepts rather than mechanistic connections through such procedures as defining, clarifying, hypothesizing, grounding, etc.[5] It minimizes memorization and stresses the importance of experience in solving a problem and arriving at a warranted conclusion. The difference between discovery approach and the expository method of teaching is that in the traditional approach, the teacher controls the information which is to be discussed. The teacher sets the framework and calls upon the students to fill in the sequence of information which she wishes to develop through knowledge recall and memorization. On the other hand, the discovery method requires more than just remembering information. The students are actively involved in processes of search, defining problems, categorizing data, setting hypothesis and taking positions to develop critical thinking.

If educationists themselves do not agree on a consistent terminology and a common definition of discovery approach, it is more so with the teachers who have been confused over what the approach really is.

Specifically, the teachers expressed confusion regarding the use of different terms, like "conceptual," "process" approach, and inductive method, to refer to what seems basically the same thing. They felt that the methods they are using in the mother units into

which population education is integrated are quite similar to the discovery approach. What they need is to be informed about the similarities and differences among them. The policy planners and researchers agreed completely with the teachers that the use of different terms to mean basically the same thing has caused this confusion in the area of population education.

However, they claimed that part of the teacher's difficulty in understanding the concept stems from the tendency to interpret the discovery approach only in terms of problem-solving. They said that the discovery approach should be looked at, not as a specific technique, but as a total environment of teaching and learning. Hence, the misconceptions of teachers and supervisors may be made clear if they thought of "discovery-oriented approaches," instead of a discovery approach.

This is further clarified by what research and education experts seem to be commonly pointing to in their discussions. The key difference, it seems, between the discovery approach and the traditional approach is that the traditional approach assumes that the teacher has full control over the teaching-learning process: the teacher decides what is to be told to the students, what learning activities the students should perform, and what responses the students should make. On the other hand, the discovery approach assumes that control over the learning process resides in the student, with the teacher playing a facilitative role. The key difference among different discovery approaches – because the discovery approach comes in different varieties – lies in whether the teacher plays a major or minor facilitative role.

Thus, when educationists differentiate the discovery approach from the traditional approach by saying the traditional approach is more structured, they mean this: in the traditional approach, the curriculum dictates the content to be learned and the teacher has almost full control over the teacher-student interaction process through which the student must somehow absorb the subject matter.

And, when educationists distinguish between different discovery approaches by saying that one discovery approach is structured, while the other is not, what they really mean by "structured" is that in both cases, control over the learning process resides in the student. However, in the first (structured) case, the teacher plays a major facilitative role; in the second case (unstructured), the teacher plays only a minor facilitative role.

In the unstructured type (Michael), students are free to explore whatever is of interest to them. It is also called inquiry non-probing (Massialas, 1970) in which students actively offer their own opinions, hypotheses or positions or explore positive or negative attitude towards an issue without defending their positions or opinions. In the highly-structured type (Bruner, 1963), the curriculum is planned so that the teacher "hides" certain specific concepts from the students. The teacher, through the use of appropriate materials and encouragement, aids the child in "discovering" hidden concepts. Massialas (1970) calls this second type as inquiry probing or guided discovery because the students are made to defend their positions and hypotheses by clarifying and defining their ideas through the use of evidences which will validate or evaluate their stand and hypothesis either spontaneously or through the teacher's prodding.

In either case, the student is supposed to discover not so much facts as relationships among facts. The students' learning activities are geared either towards *induction* (deriving a general rule through the consideration of many specific instances) or towards *deduction* (deriving the specific instance from the general rule).

Whether the teacher plays a major or a minor facilitative role depends largely on what and how much the teacher contributes – either in terms of general rules or specific instances – towards the students' attempts at deduction and induction.

The Approach Redefined

To help solve the confusion in terminology and definition, policy planners and researchers recommended that discovery approach be redefined as an environment or orientation of teaching and learning rather than a specific method. It should be viewed as a continuum of teaching alternatives, with the traditional expository method at one extreme and the unstructured discovery approach at the other. According to them, it should never be equated with the lock step problem-solving approach. The traditional expository method also should not be distinguished from the discovery approach because both belong to the same "discovery-oriented approaches."

Both teachers and supervisors unanimously recommended that any new strategy, like the discovery approach, should be introduced in a gradual manner. Specifically, they recommended the following:

1. Teachers may find the transition from the use of the expository method to the discovery method easier if their similarities are presented first and then their differences. The teachers said they are learners themselves; the old method is so ingrained in them that administrators must give them time to gradually take in the change and to be thoroughly prepared to use the method. In fact, introduction should start with the type of discovery method closest to what the teachers have been traditionally or presently using;
2. Teacher training on the discovery approach should consist of more demonstrations and practical application of theories. The supervisors felt that giving teachers excessive theories on the method will further confuse the teachers. These training should be held in the district level where re-orientation meetings on the different learning and teaching theories, followed by longer actual demonstrations, can be observed and conducted right in the classrooms;
3. In addition to demonstration sessions, PEP should regularly provide teachers with materials on the following:
   (a) The relationship between the discovery approach and the expository and other teaching methods, their definitions, procedures and uses;
   (b) Data on the effectiveness of the discovery approach gathered from research and from experience of teachers in the classrooms;
   (c) Alternative activities using the discovery approach from which the teacher can select those suited to student needs and interests;
4. The best place to acquire competence in the use of the discovery approach is in college, where population education is offered as a course. For this reason, there should be a tie-up between the PEP, which provides the population content, and the teacher training institutions, which provide the training in methodology.

EFFECTIVENESS OF DISCOVERY APPROACH: WHAT THE RESEARCH SAYS

At this point, it is not possible to summarize all the research having to do with effectiveness of the discovery approach in population education. The fact is, the number of such research studies have to do with population education is limited. And even this limited number of studies are not readily available.

The next best thing – which has been done here – is a rather selective review of the effectiveness of the discovery approach as it has been used across different subject matter areas – social studies, science, mathematics, geography and biology – across different levels, that is, elementary, high school and college. The key term here is "selective." What were selected were the studies conducted by the most competent and authoritative researchers in the field.

The studies cited are, by and large, experimental studies. They involved comparison of at least two groups (usually classrooms) that were more or less similar in all respects *except* use of teaching method. Generally, one group was taught with the traditional method while the other group (or groups) was taught with one or the other of the different discovery approaches. The groups were then compared on the basis of student outcomes, such as learning, transfer and retention, and sometimes, critical thinking, students' attitude towards the teacher and towards the subject matter. Tests measuring these different student outcome variables were administered to the students and then, gain scores (post-test scores minus pre-test scores) were compared, using statistical tests (*t*-test, analysis of variance, or analysis of co-variance) to determine whether one group had achieved significantly better scores than the other. Based on these statistical tests, inferences were made as to which teaching method is more effective.

These studies, of course, are not directly comparable. The studies differ from one another in terms of subject matter areas, students' academic levels and types of tests used. Moreover, the researchers' definitions of what the discovery approach is were not

24

consistent from study to study. And, it can safely be assumed that from study to study, teachers' abilities and skills as well as students' abilities and motivations were not necessarily at the same level.

But this lack of direct comparability is something of an advantage. If, for instance, all the research examples we had on the effectiveness of the discovery approach were in mathematics, then it could be argued that we should generalize the findings of these research studies only to math. Or, if all the research examples that we had dealt with high school students, then, it could be argued that we should generalize our findings only to subjects taught at the high school level.

But, as it is, we have research examples from many subject areas, from different academic levels and presumably, from teachers and students with different levels of competence and motivations. Thus, if the research results show that in the majority of cases, the discovery approach is superior to the traditional approach, then we can argue that this superiority does not depend on the subject matter area, the academic level of the students, the teachers' competence, or the student's motivations; that this superiority of the discovery method is *independent* of all these other factors; and that therefore, we can safely extrapolate the superiority of the discovery method to other subject matter areas, such as population education, *regardless* of other factors such as academic level, teacher competence, or students' motivations.

Problems in Evaluation

Evaluating the effectiveness of the discovery approach isn't the tedious but relatively simple matter of reviewing the research literature and finding out how many studies demonstrate its superiority to the traditional approach and how many studies do not.

First, many studies are not comparable with one another. Often, this is because different studies may use the same term to refer to two different things or use different terms to mean the same thing. What Kittel (1957) describes as "intermediate" or "normal direction" may be more directive than what Craig (1956) calls "maximum direction."

Second, partly because of these terminological difficulties, researchers have not been very specific in stating exactly what it is in the discovery approach that makes for greater learning, retention, transfer, favorable attitudes towards the course material and the teacher, class participation, or critical thinking. Is it the giving of rules or examples alone? Is it the probing of the teacher? Is it the demand that students gather evidence for and otherwise justify their answers? Is it the students' greater control over the pace at which they learn? Is it the feedback from the teacher and their classmates? Or what? And, even if all these and more had some effect on student performance, which of these characteristics are more important than others?

Third, many studies deal with many kinds of student outcomes, for example, in learning, retention, transfer. By definition, students taught by the discovery approach are not under as great pressure as are students taught by the traditional approach to learn the materials the teacher presents to them. So, if learning is measured in terms of how many items the student immediately recalls of the items the teacher presented, the traditional approach students are likely to score higher than the discovery approach students. And, if retention is measured in terms of how many items the student remembers – weeks afterwards – of the items presented by the teacher, the traditional approach students may score higher than the discovery approach students. And this is not necessarily because the traditional approach is superior to the discovery approach but because traditional approach students had learned more items and still come up with higher scores than did the discovery approach students. The solution, obviously, is to evaluate the transfer relative to how much learning took place to begin with. Unfortunately, not all the researchers have done this.

Fourth – and this proceeds from the first

three difficulties – it is not always clear whether what is being evaluated is whether students learn better when they use the discovery approach or whether students are learning how to discover. When researchers find out that students who have been taught using the discovery approach are more critical, participate more in classroom discussions, state hypotheses, back up their hypotheses with evidence, etc., a question emerges: are researchers saying that these students have learned *more* or that these students are learning *how* to learn by discovery?

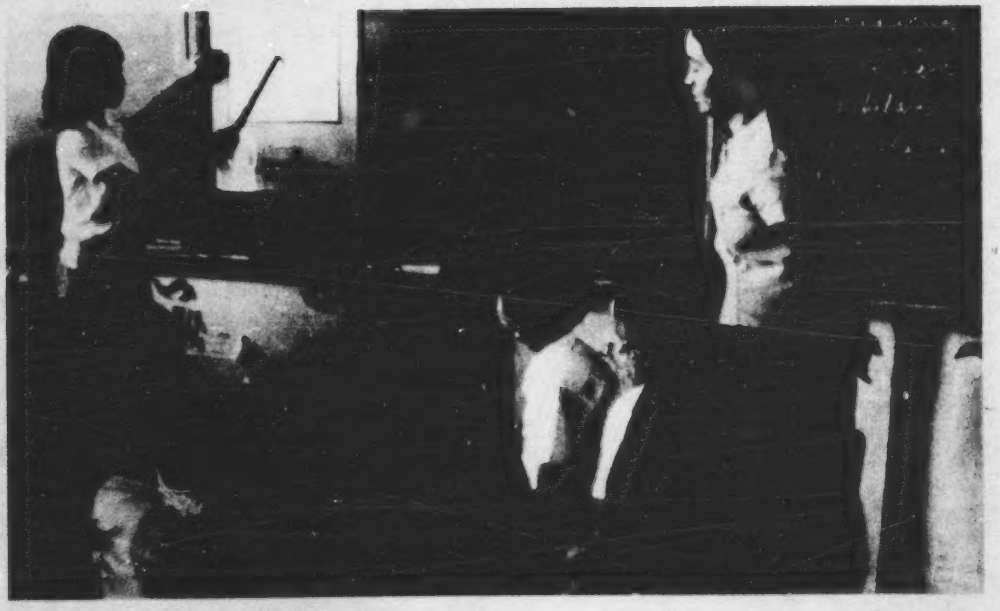
Fifth, there is a statistical problem having to do with the interpretation of a non-significant difference. This should not be a problem when one has the original article before him. However, since not all the articles are available, one often has to rely on reviews of the literature. Now, some literature reviews interpret a non-significant result conservatively, while others interpret it liberally. When we say "significant," we are merely saying that the differences between the two groups (or, in this case, methods) could have occurred by chance five times or less out of a hundred. In other words, if we had 100 studies with exactly the same results and we said that in each of these 100 studies, the discovery method was better than the traditional method, we would be correct in at least 95 instances – since in the rest of the intances, the differences we would observe would be due to chance. Or, to put it still in another way, if we were to assert that the discovery method is better than the traditional method, we would be correct at least 95 per cent of the time and wrong the rest of the time. In any case, when we speak of a significant difference, we are saying that it is far more prudent for us to believe in the superiority of the discovery method than in the equal effectiveness of both methods. Exactly how to interpret a non-significant difference between two groups seems to be a question of how liberal or conservative one is in interpreting statistical tests. The liberal interpretation is that the two groups (or, in this case, the two approaches) are more or less equal, meaning to say, one method is just as good as the other. The more conservative interpretation is that one group could be better than the other but "we cannot discount the possibility that the differences we observe between the two groups is simply a matter of chance." Thus, if out of 100 comparisons, 30 are significantly in favor of the traditional approach, and 30 yield non-significant differences, the conservative interpretation is: "in 40 out of 100 comparisons, the discovery approach was superior to the traditional approach." The liberal interpretation, however, is: "in 70 out of 100 comparisons, the discovery approach proved to be as good as, if not better than, the traditional approach."

Given the above qualifications on the difficulties of interpreting different research studies – especially if one does not have the full research report to work from, the following rather oversimplified generalizations may be made.

1. **The discovery approach seems to be more effective than the traditional expository approach in bringing about learning, retention, and transfer. And, when different kinds of discovery approaches are compared, the guided discovery seems to be more effective than the independent discovery approach.**

Wittrock (1962) divided 292 college students into four groups, each group learning how to decipher transposition codes by different types of instruction. Giving rules without examples proved to be more effective in promoting initial learning of subject matter and on retention and transfer to new and similar examples than giving examples without rules, giving both examples and rules, or giving neither examples nor rules.

Craig's (1956) directed discovery group, composed of 53 sophomores and juniors who received rules or statements of principles "to look for answers and relationships regarding words that do not belong," resulted in the learning of more answers. Even if the



27

independent discovery group retained and transferred as well as the directed discovery group after some time, the directed discovery group still had the advantage of retaining more in terms of numbers because they learned more in the first place.

Kittel (1957) reached a similar conclusion in his experiment of 132 sixth-graders who were placed into three treatment groups receiving three amounts of direction – minimum, intermediate and maximum. The students were to discover principles for solving multiple-choice verbal items. The group receiving an intermediate amount of direction (organized materials, information of such organization and statements of underlying rules or relationships) learned and transferred as many or more principles to three different situations than the minimum group (example given but not rule) or the maximum group (rules and answers given). Furthermore, two or four weeks after training, the intermediate direction group retained more of what was learned than the other two groups.

Guthrie (1967) found that the discovery method (giving examples to discover rule) facilitated transfer but not retention. On the other hand, expository instruction (giving both rules and answers) facilitated retention. It seems that the example group or those who were given the discovery approach of instruction rated high in transfer. The subjects were taught to explore and search, and this exploratory behavior was reinforced whenever any concept or word suited the examples given. Gagne and Brown's (1961) guided discovery group, Katona's (1940) understanding group, and Forgus and Schwartz's (1957) observer group are all examples of giving rules (without answers) which are found to produce retention and transfer of learned rules as well as or better than any other groups in their respective experiments.

Amidon and Flanders (1969) determined the effects of direct versus indirect teacher behavior and of clear versus unclear student perception of the learning goal on the achievement of 8th grade geometry students. One hundred forty-eight graders were assigned randomly to one of the following four experimental treatments: direct teacher influence with clear goals, direct teacher influence with unclear goals, indirect teacher influence with clear goals, and indirect teacher influence with unclear goals. At appropriate points, students' perception of clarity of goal and their perceptions of the teacher were measured by paper-and-pencil tests. While clarity of goals had no effect, the kind of influence exerted by the teacher did: children taught by the indirect teacher learned more than did the children taught by the direct teacher. How did the teacher who gave indirect influence in teaching geometry make her students learn more? The study described her as giving less lectures and instead asked more questions, thus encouraging class participation. She gave fewer directions, less criticism, more praise and clarified student ideas. Only three studies included in this survey (Kersh, 1962; Guthrie, 1967; Roughead and Scandura, 1967) found no difference in effects among the various methods of teaching on retention and transfer. Roughead and Scandura tested 103 female junior and senior elementary education majors regarding their ability to derive solutions on some mathematics problems. They found that what is learned through guided discovery can be taught just as effectively by exposition. Kersh (1953) found no significant difference between independent discovery and guided discovery on the learning, retention and transfer of college students taught mathematical formulations. Similarly, Young (1967) found no significant differences when he tested fourth grade children on science: that children exposed to different types of inquiry program did not achieve more academically or become more autonomous in learning than children in the expository group.

No significant differences in learning, retention or transfer were found among students taught by different teaching techniques by Roughead and Scandura (1967) and Kersh (1962). These, however, offered some explanation of the behavior of students who were given either all the rules and answers (expository) and those who were given no help at all (in-

dependent discovery).

Roughead and Scandura stated: if a person is given both the rules and answers and if he has already mastered the rules or associations by which responses can be derived, it is not likely that he will waste much time trying to find out other ways to derive them. In other words, when correct responses are already specified in advance of activity, students are given little reason to search or discover. Hence, giving specific answers and rules may retard retention and transfer. There is insufficient practice and reinforcement for applying the rule since students do not find a need for it. In short, mastered prior knowledge may actually interfere in a very substantial way with later opportunities for discovery. However, for initial learning of answers rather than the retention or transfer of what has been learned, Wittrock (1962) stated that rules- and answers-giving is better.

Kersh (1962) suggested that students who were not offered any help at all or given guidance (independent discovery) were motivated to continue looking for the answers. Independent or unstructured discovery forces the learner to rely on his own learning capacity and, consequently, becomes motivated to continue the learning process or practice the task even after the learning period. The child is able to approach learning as a task of discovering something rather than being forced to learn about it. Thus, the child's tendency to carry out his learning activities with the autonomy of self-reward or by the reward is discovery itself.

In a rule-given situation (guided discovery), the students are not only given simple rules but also are rewarded for applying them to particular problems. Furthermore, they are given the chance to practice them frequently. The students may not have discovered the rule but they can discover how to apply or transfer them in the future. Bruner (1963) suggested the very activities that characterize "figuring out" or discovering things for oneself also seem to have the effect of making material more readily accessible in memory. But Shulman and Keislar (1966), who found that a learner who discovers

is more able to express his knowledge and is able to integrate it in his vocabulary and speech, cautioned that discovery without guidance is a terribly slow process. It requires more time than the other process of acquiring and storing knowledge. Therefore, discovery approach should be equated with laissez-faire educational philosophy. Students can be encouraged, prodded and shaped to discover, but a certain degree of control should exist.

Most of the teachers said the expository method probably induces faster learning because students are under great pressure to memorize materials presented in the classroom. But these teachers' experience has been that facts learned through memorization are not retained for very long; after taking tests, students immediately forget what answers they gave.

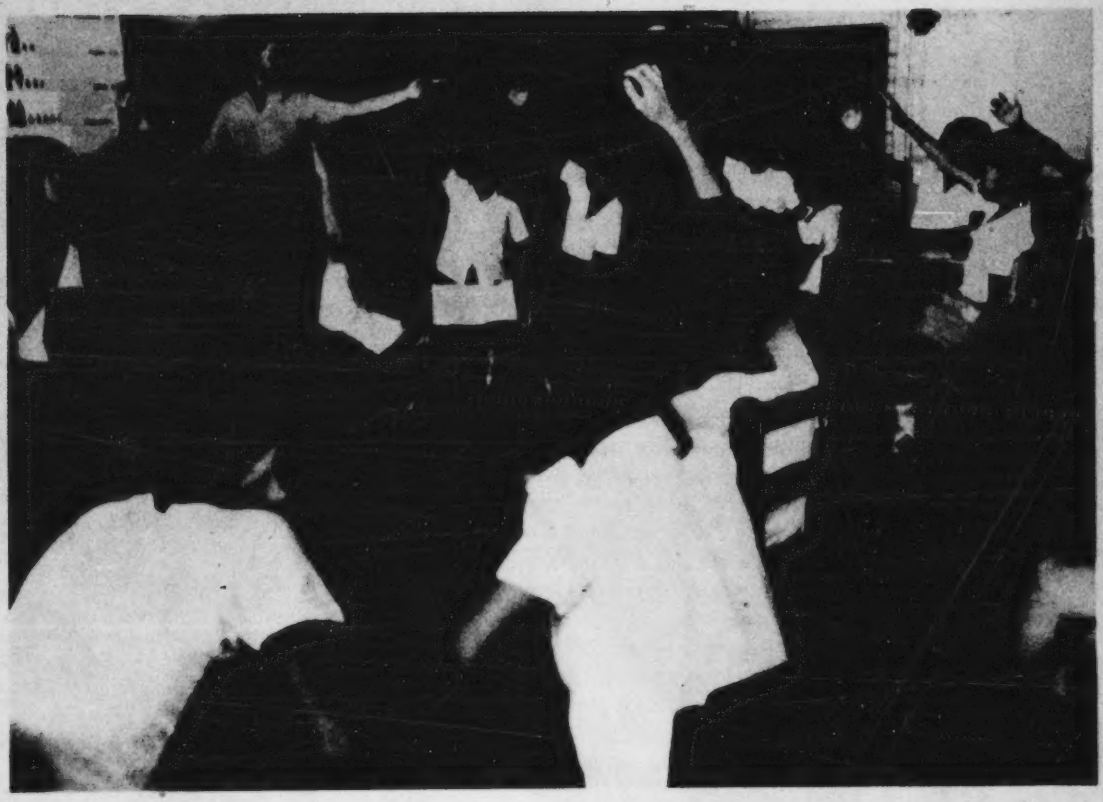
The policy planners and researchers supported the teachers' experience, citing a study done by Jack Cousin of Indiana University. Cousin found isolated information seemed to be retained longer when acquired by discovery rather than by the expository method.

2. The discovery approach seems to be more effective than the traditional expository approach in stimulating critical thinking, and, in so doing, more active student participation in the classroom.

Bruner (1960) and Suchman (1961) concluded that the discovery approach helps develop thinking and problem-solving ability. They argued that the discovery approach teaches a student to go about the very task of learning through the techniques or the procedures of inquiry. Supporting this conclusion, Grandall's (1960) study showed that high-achieving children who received discovery approach education are less dependent on adults for help and emotional support. Bruner (1959) compared two fifth grade geography classes. Class A pupils were given the discovery critical thinking and participation treatment. They were asked to identify cities and bodies of water in a blank map of nameless tracings of rivers and lakes, and cities with corresponding justifications for their identification. Class B pupils were given maps complete with names of cities and bodies of water and took down notes and memorized the names of cities and rivers. After application of achievement tests, class A pupils learned geography as a set of rational acts of induction through more active discussion and critical thinking. The class B pupils stored names and positions as a passive form of registration.

Similar results regarding positive correlation between discovery approach and the students' ability to think independently, attitude to course, and participation were also supported by Enstam (1974). He compared freshmen college students who used electronic media in an inquiry program of teaching in six freshman courses in English, history, psychology, sociology, religion and physical science. Instead of class lectures, the students were given audio tapes and video tapes for factual information about the courses and made use of them at their convenient time and place. Class time devoted to discussion of questions and issues, analysis and synthesis of related information. The results showed students participated actively in class discussions, were more critical and aware of themselves, and generally expressed their ideas more than students in the traditional classes.

Massialas (1970) demonstrated the superiority of guided discovery or inquiry-probing against either the expository or unstructured inquiry non-probing method in promoting critical thinking in the discussion of social issues among social studies students. Furthermore, students in the inquiry-probing or guided discovery class performed better in the social issues critical-thinking test than students in either of the two groups. Generally, however, the discovery groups, whether the inquiry-probing or the inquiry non-probing, participated more in class discussions than in expository classes. Massialas also identified and isolated the characteristics of the critical discussion of social issues which occurred in inquiry-probing and inquiry non-probing situa-



tions. In the inquiry non-probing method, the students recognized a problem and then offered opinions, hypotheses or positions. They explored positive and negative attitudes and feelings towards a social issue without defending their positions. The students rarely moved naturally from position to grounding nor did their teachers intervene and ask them to support their ideas. In the inquiry-probing method, the students not only recognized the problem and offered hypotheses, but also clarified and defined their ideas and most importantly, used evidences to validate or ground their positions either spontaneously or through the guidance of the teacher. Students in the inquiry-probing classes performed better on the critical thinking test than students in either the expository or inquiry non-probing classes.

Young (1967) did not show any significant relationship between the use of discovery approach and the students' academic achievement and independence in his study of Grade 4 children studying science. He demonstrated, however, that children who had been exposed to the inquiry program were more able to inquire, offer and test more explanations to problem situations than children who received the traditional teaching method.

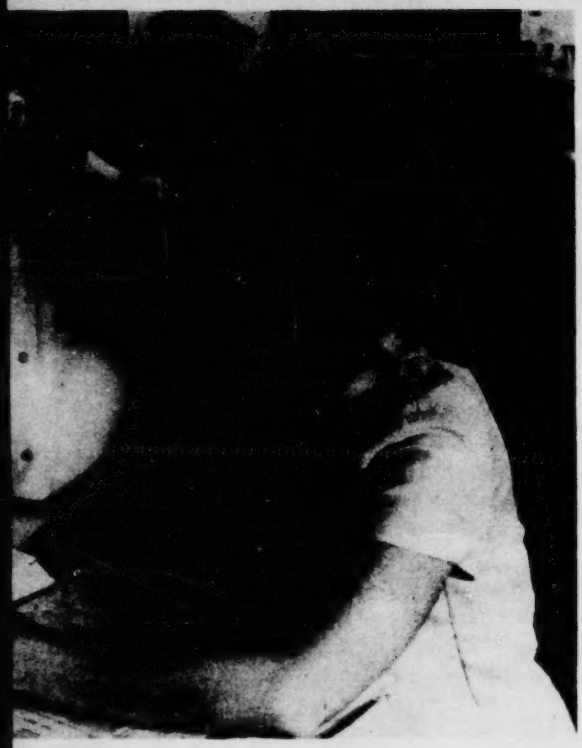
In the Philippines, Ramos (1971) compared two groups of sixth-grade science students: one under a discovery-centered pattern of instruction and the other under a teacher-centered pattern. Ramos found that the discovery-centered students were superior in critical thinking, especially in the component skill of making inferences about a given or observed data. However, they were no different from the teacher-centered students on the mastery of facts.

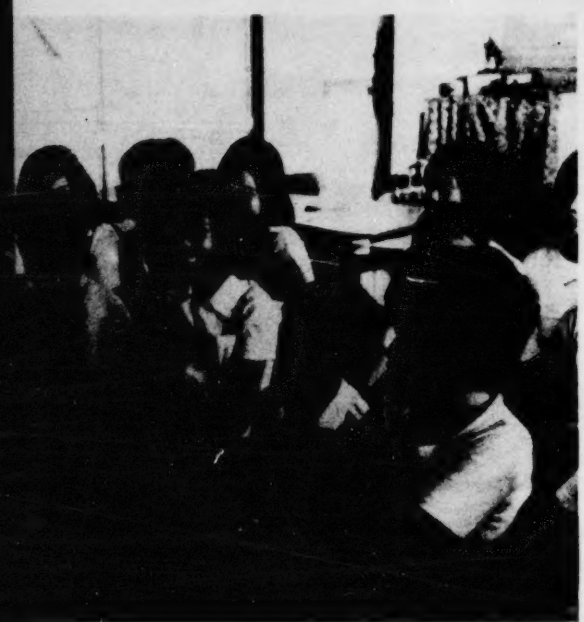
3. The discovery approach seems to be more effective than the traditional expository approach in developing in students a favorable attitude towards the subject matter and towards teacher.

Massialas (1970) found that in inquiry-probing classes, students felt more positively towards their teacher's style of class maintenance and support than in either expository or inquiry non-probing classes. Students in the inquiry-probing classes felt that more order and purpose were in their class since the teacher gave them guidance as well as the chance to demonstrate their inquiry skill. The expository class came in second; and the non-inquiry class felt the least positive about their teacher and the classroom as a whole. They considered the discussion purposeless, aimless and frustrating since the teacher had no initiative in exploring ideas. Enstam (1974) suggested that students who were given the inquiry program through the use of media, like audio tapes, video tapes and "autopaks" (rather than lectures in learning about factual information) were more favorable towards the course. But this suggestion was inferred from their high grades, their active participation in the classroom discussions and their ability to go about their learning task independently.

Locally, Villavicencio (1973) used several evaluation tests – achievement and comprehensive tests in Biology, Teacher Attitude test, Teacher Laboratory Attitude test, Student Laboratory Attitude Scale and processes of science test – to evaluate the effects of the inquiry-oriented Biology in-service Summer Institute Program. The tests were on the knowledge, attitude understanding and achievement of 25 teachers and 260 students towards Biology teaching. Villavicencio found: students of trained teachers who applied their training not only performed better on the Biology achievement test than did students of non-trained teachers but were also more favorable towards the course and the laboratory exercises.

32





4. The effectiveness of the discovery approach depends to some extent on teacher competence: the more competent the teacher, the more likely the discovery approach is to be more effective.

Here, there is a certain amount of ambiguity because "competence" tends to be used in two senses. Sometimes, "competence" refers to the teacher's over-all mastery of the subject matter; sometimes, "competence" refers to teaching skill – the ability to motivate students to discover things for themselves. In the real world, it is generally very difficult to tell where subject matter competence ends and methodological competence (teaching skill) begins.

When researchers find no significant difference in performance between student learning by the discovery approach and students learning by the traditional approach, one of the most frequent explanations they make is the lack of teacher competence.

The issue of teacher competence is, of course, bound up very closely with the larger issue of what knowledge, attitudes and skills the teacher brings with her to the classroom which affect the effectiveness of her teaching. Here, the evidence is mixed.

Shaver and Richards (1971) tried to find out the effects of students' and teachers' personalities, like dogmatism, authoritarianism and rigidity in their attitude towards the course and the teacher who made use of the inquiry method in teaching social issues in a social studies classroom. It was hypothesized: since the subjects' personality, like closed-minded, dogmatic, rigid, etc., conflicts with the very nature of the inquiry process like reflective, often, the students would score low in the achievement test and have a negative attitude towards the teacher and the course. However, these hypotheses were not supported. There was no significant relationship between the personality measures and learning.

Most of the studies reviewed earlier ascribed low students performance in the "no-help," independent, minimum, and inquiry non-probing" groups directly or indirectly to

teachers' lack of competence. Kittell (1957) acknowledged in his study the teacher's role in providing direction in learning-teaching situations. He suggested that in addition to organizing the materials used in learning, teachers should aid pupils by suggesting meaningful relationship on which learners may base discovery and by providing practice with the relationships."

Local researchers have shown that the discovery approach is not advisable unless teachers are properly oriented in its use (Silvestre, 1973). As it is, even administrators admit to a lack of knowledge about it (Alburo, 1972).

Teachers themselves are aware that the guided discovery type requires in-depth exploration of the subject matter. This, in turn, places high demands on the teacher's competence and her willingness to entertain questions. In fact, many teachers, because of incompetence, insecurity, or other factors, often do not create the right atmosphere. They confidently lay down half truths as gospel truths just because they were uttered by an authority. If a teacher or audience is not prepared to discuss or debate the values and issues at stake, the teaching can verge on the manipulative.[6]

Interviews with a selected sample of administrators and curriculum writers reveal that they are agreed that some teachers are still ill-equipped to handle controversial population content; that teachers who do not know how to go about teaching human sexuality may either embark on indoctrination or avoid the topic altogether. Administrators in the curriculum development group were not satisfied with the way many teachers use the discovery approach. They have informally observed that instead of encouraging students to be more independent or self-reliant in their answers, not all teachers are willing to relinquish their role as "source of all wisdom and truth."

Reactions on Teacher Competence

All teachers, supervisors, policy planners and researchers agreed that the effective use of the discovery approach depends to the *largest* extent on teacher competence. For them competence does not consist merely in knowledge of the concepts of population. Competence is defined as the "teacher's overall mastery of the subject and his/her teaching skills or ability to motivate students to discover things for themselves." It includes: (a) mastery of knowledge in population and the mother subject to enable the teacher to integrate population concepts into the appropriate topics in the mother unit, and to competently discuss population concepts using the discovery approach; and (b) mastery of teaching, using the discovery approach. This means being able to raise the right questions, guide the students in formulating hypotheses, and motivate them to discovery the answers for themselves. A teacher's personality is also considered a facilitative factor in the success of the discovery approach. Accordingly, a teacher should be open-minded, interested, pleasant, innovative, patient, energetic and resourceful.

In fact, teachers and supervisors consider teacher competence as the *most important* condition that can contribute to the successful use of the discovery approach. It is more important and crucial than either or both student competence and the appropriateness of the curriculum content. If a teacher is competent in the discovery approach, he will know how to modify the application of the method so slow learners will get more guidance while fast learners will receive just the right amount of direction. Similarly, it is the teacher's competence in using curriculum materials that will figure the most in bringing about learning in the student. According to supervisors and teachers, the curriculum is not a strait-jacket; it is up to the teacher to innovate, add to, or modify materials in the curriculum to make it applicable to various types of students.

Inadequate Population Education Training

The objectives of the population education program of equipping the teachers with the full knowledge and skills to teach population educa-

tion are not being completely met by the training program: the teachers complained that the one-week provided to them by the Supervisory Training Teams (STTs) on population education did not convey enough knowledge on population to enable them to use the discovery method effectively.

Some supervisors felt, however, that the one-week training they are giving to teachers is sufficient insofar as providing them the knowledge to teach basic population concepts to students in the elementary level is concerned. The use of the discovery approach calls for a deeper discussion and enrichment concepts which are already found in the teaching guides. However, other supervisors agreed that the one-week training given to teachers does not provide broad knowledge, but they said the limited concepts given during this training are sufficient if the teacher is skilled in the use of discovery method.

Teachers, supervisors, policy planners and researchers recognized that the present program for teacher training cannot guarantee that it will turn out teachers competent in the discovery method. This is regardless of the fact that the major objective of the population education training programs for teachers and supervisors, as far as skill is concerned, is "to develop in them the competence to use the discovery approach."[7] Based on the experience of the teachers, the policy planners and researchers observed: there appears to be a progressive dilution of the content and quality of the training, as it is diffused from the higher to the lower levels. They asked (a) whether division-level administrators are best suited for the role of trainors in population education; and (b) whether what these administrators learn in a five-week training course in Manila is not in fact lost in a one-week echo seminar for teachers in the provinces.

35

Recommendations to Upgrade Teacher Competence

The population education professionals recommended a number of steps to solve the problem of teacher competence. Among these are:

1. Longer and better quality in-service and pre-service training both in population education and the discovery approach to enhance teacher competence should be conducted. If longer practicum sessions in the use of discovery approach cannot be accommodated in the one-week population education training for teachers, a separate training on the discovery method should be organized. The recommended training formats are: (a) Training should emphasize demonstrations and practicum rather than theories; (b) Teaching modules on the various population education topics should be presented in a discovery-oriented manner; and (c) Materials to be used in the training should also be discovery-oriented.
2. Teacher retraining should be included in the PEP plans to upgrade teacher competence and knowledge on some population content which were either not taken up, or were inadequately covered, in the first training given to teachers. The planning of the content and strategy of this retraining schemes should be based on a district-by-district evaluation of the following: (a) the present knowledge level of teachers on population, to find out what topics were sufficiently covered during their first training, what topics need to be reviewed and what topics were not included in the first training but are necessary for teaching; (b) the attitude of teachers towards population education; and (c) the extent to which teachers are actually integrating the population education program effectively and properly into their teaching.

   Baseline data on this enable planners of the teacher retraining programs to fit the content and strategy of the training to teachers' needs and interests at the local level. The assumption here is that teacher retraining will be planned and carried out at the district level.
3. Mrs. Remedios Cayari, PEP program officer for curriculum development, said during the policy planners and researchers' conference that she does not consider the use of the discovery approach in population education problematic. If there are problems arising from the use of the method, these should be tackled in the pre-service training provided by teacher training institutions in various subject disciplines, she said. According to Mrs. Cayari, the best place to acquire competence in the use of the discovery approach is in a college where a population education is offered as a course. For this reason, the policy planners and researchers recommended that PEP (which provides the population content) tie up with teacher training institutions (which provide training on methodology);
4. Administrators should organize professional groups in schools to help monitor feedback and evaluate the effectiveness of the discovery method in teaching population education.
5. The PEP should regularly provide materials on the effectiveness of the discovery approach from research and from the experience of teachers in the classroom; and
6. Schools should subscribe regularly to professional reading materials containing significant research findings which will help inform and update teachers on the use of the discovery approach.

A Time for Stock-taking

Population education professionals are agreed that teacher competence contributes to the largest extent to the effective use of

discovery approach and the integration of population education into mother units. They realize, however, that ultimately, the issue of teacher training has to be dealt with if teacher competence is to be insured and upgraded.

The policy makers and researchers agreed on the need for an appraisal of the present training scheme. A supervisor even suggested that expansion of the training program and the holding of echo seminars be temporarily stopped to allow for stock-taking of the following population education training areas:

1. Review the present system of training division-level administrators as trainors on the following questions:
   (a) Are the division-level administrators or supervisors the best trainors for population education?
   (b) Are middlemen necessary in training teachers or should teachers be trained directly by the central office?
   (c) Is the use of the resource persons from within the locality more effective than the use of resource persons from outside?
2. For planning the content and strategy of teacher re-training, conduct a district-by-district evaluation of the following:
   (a) The present population knowledge of teachers gained from the first training, to find out what necessary population topics have been sufficiently covered, need to be reviewed, or have not been included;
   (b) The attitude of teachers towards population education;
   (c) The modular approach as a better alternative to the present training strategy;
   (d) If the one-week training being given to teachers is sufficient to enable them to teach population education competently;
   (e) The present strategy of training teachers coming from the same grade levels or subject areas from different schools. According to some supervisors, this strategy does not ensure continuity of training or implementation of population education. As a result, some schools have only primary teachers or only social studies teachers teaching population education. Some supervisors suggested that training should instead be provided to teachers from all grade levels and subject areas in one school, starting with the central school, and then move down to the municipal schools.
3. Conduct a study to determine the extent to which teachers are integrating population concepts into the mother units and identify the factors behind the failure of trained teachers to do this.

In this regard, the supervisors felt that the creation of an item for a full-time population education supervisor by the PEP will make possible a more intensive and more systematic follow-up and monitoring of teachers in the classrooms. At present, supervisors feel they cannot cope with the demand for follow-up and supervision of population education because they have many other projects to attend to. Often there is no follow-up of teacher training. With the creation of this item, supervisors hope that teacher demand for closer supervision, more regular dialogues and evaluation of their performance will be met.

5. The effectiveness of the discovery approach depends to some extent on student competence: the more competent the student, the more likely he is to learn under the discovery approach than under the traditional approach.

Sowder (1969) found that lower-ability individuals can make some discoveries in mathematics computation at a slower rate. It also shows that pupils' performance with grade improve through Grade 6. Hence, the author recommends that other objectives being equal (motivation, interest, drill, etc.), the most efficient use of such discovery tasks will appear after Grade 5 when pupils have acquired more skills, understanding and insights, and can consequently form generalizations better. The study indicated that most pupils can form generalizations of mathematics computation while pupils of lower IQ require examples or problem-solving exercises. With the number of instances needed as a criterion, the optimum level as which to offer generalization tasks appears to be Grade 6 or after.

In this connection, Shaver and Richards (1971) had ambiguous results when they correlated student personality measures with performance. The correlations were not significant.

Reactions on Student Competence

There is a unanimous feeling among teachers, supervisors, policy planners and researchers that the effectiveness of the discovery approach depends to a certain extent on student competence. And competence, in turn, may be affected by the student's general and mental ability, his motivation and his prior knowledge of the subject matter. There is thus a need to study how these factors influence the effectiveness of the method, for instance, how much fast and slow learners can benefit from it, how much guidance from the teacher is needed to insure higher motivation and whether prior knowledge reinforces or discourages learning, and to make the necessary adaptations.

These four groups of population education professionals further explored and discussed the following areas of student competence:

I *General and mental ability* – Most of the teachers recognized the differences to the extent that the discovery method can be applied to children with different levels of ability. They pointed out that slow learners are usually less able to go through the discovery process of raising questions or forming hypotheses and searching for the answers on their own.

The science and mathematics supervisors contested this, saying that there are no slow learners, only pupils who are poorly motivated. They argued further that a pupil does not control his own learning, but the teacher does.

The policy planners and researchers were more on the side of the teachers. They maintained that the teachers' role in the discovery approach is to relate the content and pacing of his teaching on the pupil's frame of reference and understanding. Ultimately, however, the control of learning rests on the pupil. Therefore, they stressed that learning should be highly student-oriented, and that teachers should de-emphasize their role as moderator of learning. They also agreed with the teachers that there are indeed children who are slow in learning, citing the case of the blind, the mute, the mentally retarded and others with learning disabilities. But they agreed with the supervisors that success in learning among slow learners depends upon teachers' motivation.

II *Students' motivation* – The teachers agreed that too much guidance, meaning, spoon-feeding the correct method of solving a problem in advance, as in the expository method, lowers the students' motivation to discover means and answer by themselves. A little guidance motivates children to continue looking for answers; but too little guidance they said, might discourage children who have low mental ability and little interest in the subject matter. This is opposed to a research finding by Kersh (1962) which says that

students who are not offered any help or guidance are usually motivated to continue looking for the unknown answer. The social studies teachers said this depends upon the student's mental ability and interest to continue searching: those with lower intelligence or interest will need constant prodding from the teacher.

III *Prior knowledge* – All the teachers and the science and mathematics supervisors believed that a student's prior knowledge could substantially affect his bent for discovery. But the teachers were divided on whether prior knowledge reinforces or interferes with learning.

Some teachers believed that a student's past knowledge on the subject encourages discovery of related concepts and, therefore, facilitates further knowledge.

Some felt, on the other hand, that students are less likely to be interested in discovering a subject matter they already know. Conversely, they will be more motivated to discover facts and concepts which are new to them.

Others said that the effect of prior knowledge on a student's learning behavior depends on the quality of the prior knowledge. If new knowledge contradicts prior knowledge and prior knowledge is considered the more authoritative of the two, the new knowledge may be rejected. Or worse, this may dampen the student's enthusiasm in making further discoveries.

Policy planners and researchers stressed that an understanding of the content and nature of prior knowledge and its relationship to the lesson is important in determining whether it will reinforce or interfere with learning.

Recommendations

The following recommendations were formulated by the program professionals to solve the problem of student competence:

1. Provide slow learners with enough time to learn by the discovery method;
2. To slow learners, teach easier and fewer concepts, and to fast learners, teach more complex and more concepts;
3. Slow learners should be taught by guided discovery; fast learners by more independent discovery;
4. Pupils in the lower elementary level

should be taught by the guided discovery approach as they are generally unprepared for independent decision-making. For students in the upper elementary, high school and college levels, teachers prescribed the unstructured or independent type of discovery approach. They said students at these levels have already acquired more skills, understanding, and insights and, therefore, can form generalizations better;

5. The teachers further suggested that guided discovery be used in the beginning or the early part of the school year. After the students have more or less learned the process of discovery, they could be taught with the unstructured approach; and
6. Tests should be given to students at the beginning of the school year to determine profiles and levels of mental ability. This will help teachers identify the slow and fast learners. The teachers can then program the amount and kind of guidance she will provide to the different students.

Evaluating Students' Competence in the Use of Discovery Approach

In the preceding paragraphs of the literature review, it has been stated that the population education program is more interested in the *process* through which the student decides on his population – related behavior rather than in the product – the student's actual decision itself. For this reason, the program has decided to use the discovery approach as the appropriate teaching strategy in population education. Through this strategy, the student is supposed to discover not so much facts as relationships among facts.

If this is the case, teachers felt that tests discriminate against students taught by the discovery method because these tests aim at memory skills rather than critical thinking. In this kind of tests, although the experiences of discovery-taught students are richer, they appear to have learned less than those taught by the traditional approach.

Most teachers and supervisors felt that the performance of students taught by the discovery approach should be assessed with an orientation towards process (by which performance is evaluated in terms of how the student explores, discovers and establishes relationships among facts); those taught by the expository method, by an orientation toward content (by which performance is evaluated in terms of the facts that the students learn). On the other hand, science, mathematics and home economics teachers and social studies supervisors took the position that teachers should not hesitate to measure whether students are learning through discovery even if they had been taught in the traditional method.

Other supervisors took the position that testing should depend on the objective of the teaching situation: where the learning of facts is desired, a test with content orientation would be appropriate; where skill in problem-solving is wanted, a test with process orientation would be justified.

Policy planners and researchers did not go along with this dichotomization of measurement of teaching outcomes. They said it would be more practical and logical to view content and process as integral parts of any test, though some tests may focus on either as the objective demands. This kind of measurement is more suited to the Philippine educational system where learning is derived more from teachers in the classroom than from any other sources.

The following tests can be used to measure whether students are learning from the discovery approach:

1. Observation analysis and problem-solving tests;
2. Tests making use of rating scales;
3. Personality test;
4. Practicum tests;
5. Cause-effect tests;
6. Open-ended test; and
7. Criterion reference tests.

6. The effectiveness of the discovery approach depends to some extent on how much time is available for instruction.

Since the discovery approach is a slow process, sufficient time should be allowed for students to really conduct an inquiry task. Guthrie (1967) found that the achievement of retention by using the discovery approach depends upon time. He said that when speed of learning and retention was used as criteria, instruction containing rules (expository) was superior to that without rules (discovery approach). Therefore, the research clearly demonstrates that if one wants to produce faster learning and better retention, then the rules and expository method should be used.

Young (1967) compared three groups of fourth-graders – two using the discovery approach and one the traditional approach. The study did not demonstrate that children who have been exposed to the inquiry program had a higher level of academic achievement or were more autonomous than the children in the control group. One of the factors given by the author which has contributed to the methods minimal success was insufficient exposure to the material, due to lack of time.

These research findings were found to be true regarding teachers' experiences in the classrooms. Teachers were unanimous in saying that the effectiveness of the discovery approach depends to some extent on the amount of time given for instruction and class activities. They agreed that, by definition, the discovery approach requires that schedules be flexible. They said teachers should be allowed more flexibility in conforming to the time allotted for specific lessons in the curriculum.

The teachers unanimously agreed that supervisors and administrators should entrust to them the planning and budgeting of teaching time. After all, they said, it is they who know their students best. The science and mathematics supervisors agreed that schedules should be flexible, adding that the syllabus should be looked upon as merely suggestive and not necessarily prescriptive. However, they said, any planned activity should always have a tentative time schedule, and the guided discovery approach would seem to be the most ideal in terms of setting a guide time limit.

Other supervisors said they do tell the teachers to devote more time to discussions of more difficult concepts. In practice, however, the teachers find it almost impossible to be flexible about their time schedule because they are already working under heavy loads; the addition of many other topics like nutrition, environment and drug addiction into what they teach has put greater strain on their time and resources. The supervisors said they disagreed with the teachers' observation "heavy teaching loads" have rendered almost impossible the teachers' flexibility in scheduling time. Successful integration, they said, depends on the teacher. A teacher with an interdisciplinary orientation would be able to bring nutrition, drug addiction, population education and environment into the mother unit without requiring extra time for all these sub-units. In this regard, many teachers probably could not see how all these sub-units could be integrated into the mother unit in a single class period. It is possible that the provision of separate teaching guides for syllabi on these different topics has given teachers the mistaken notion that these syllabi are additional content ot the curriculum.

More Time for Class Work and Homework

The teachers agreed that the discovery approach requires more of their time and that of students to complete class work and homework. Students get more problems to solve which require a lot of research and field interviews. One social studies teacher said it is often impractical to assign problems and research to students because students have little time left to work on them. After a student is dismissed from class in the afternoon, he is expected to go to the library to consult reference materials. But often the library is closed by five, so he can no longer avail of its facilities. Even if it were open, the needed materials may not always be available. Given these circumstances, the teacher has no choice but to revert to the expository method of teaching.

Recommendation on Flexibility of Time for Teaching Through Discovery Approach

To give them enough time to use the discovery approach effectively, particularly in population education, the teachers recommended that the size of classes and their teaching loads be reduced. However, the supervisors disagreed with the recommendation. They said reduced size of classes and reduced teachers load do not necessarily affect the effective use of the discovery approach. It seems that teachers appear to have acquired the wrong notion that a "heavy teaching load" requires more teaching time. They suggested instead that teachers should be taught how to integrate different topics into a mother unit, using just one class period.

The supervisors also suggested that teachers should arrange with fellow teachers for an exchange of class periods to achieve continuity in their lessons.

Furthermore, teachers recommended that restrictions on the use of facilities like the library and equipment in science, home economics and art be eased so students can use them beyond regular office and class hours.

42

OTHER VARIABLES

After the literature review has enumerated the six empirically-based propositions evaluating the effectiveness of the discovery approach relative to the traditional expository approach, the teachers and supervisors cited four other important conditions that could qualify the effectiveness of the discovery approach. These variables were not taken up in the original literature review as no available research studies could show that they are direct contributory factors in attaining effective use of discovery approach. Nevertheless, the teachers, supervisors, and policy-planners identified these issues in the conferences based on their practical experiences from the field.

1. The effectiveness of the discovery approach depends on some extent on administrative support: the more support the teacher gets from his supervisors or superiors, the more likely the discovery approach is to be effective.

   Teachers have reported they could not use the discovery approach effectively because some supervisors have a negative attitude towards, or do not support, the use of the method. Often, teachers would like to conduct more method-related activities such as field trips, visits to the library and gaming exercises, but are deterred from doing so for the following reasons:

   1. Some administrators are often reluctant to allow field trips and other outdoor activities. They are apparently afraid to take responsibility for any untoward incidents that may occur during these activities. The teachers have to take the risk themselves. However, in doing so, the teachers have a tendency to control the movements and hence, the discovery activities of the students. Every outdoor activity at present requires written permission from the students' parents. This takes time to obtain and disrupts the continuity and spontaneity of the activity.

2. Some supervisors or coordinators have a tendency to pressure teachers into restricting subjects they are coordinating. This generally inhibits teachers from coming up with innovations or suggestions;
3. Inadequate facilities and lack of teaching aids also hinder the teachers from effectively implementing the discovery approach. They said the approach calls for more and varied types of activity, including gaming sessions, research, field trips, library visits and experimentation. These require adequate and more extensive use of facilities which include laboratory equipment, art materials, library and teaching aids. But as things stand, many teachers have to use their own money to buy even basic supplies like chalk and art materials. Furthermore, there are severe restrictions on the use of the school library, laboratory equipment and other facilities.

The supervisors agreed that they should provide the appropriate environment and encouragement for the self-improvement of teachers. They contended, however, that full support has already been given to teachers as far as their administrative and financial resources will allow. Policy planners and researchers noted with some surprise the reference to lack of support from administrators and supervisors. They suggested that instead of depending too much on materials and other kinds of aid from outside agencies, the teachers should be more creative and resourceful in using local materials and the natural environment in planning activities according to the discovery approach.

They traced the prevalent lack of administrative support and restrictive atmosphere to the bureaucratic system of education in the country, which does not encourage the use of discovery approach.

Recommendations to Gain Administrative Support for the Use of Discovery Approach

To gain the support of administrators, the teachers, supervisors, policy planners and researchers recommended the following:

1. An administrative support for outdoor activities, the supervisors suggested that teachers, instead of asking permission from parents and administrators every time a field trip is planned, should obtain this at enrollment time or the start of the school year. This permission should apply to all out-of-school activities during this school year. Also, outdoor activities can be planned in such a way that the sites chosen are only about 20 minutes away from the school;
2. Administrators should be retrained so that they will be more open to teachers' suggestions and more responsive to innovation;
3. More regular dialogues should be held between administrators and teachers on the later's progress and difficulties with the discovery method;

4. The PEP should (a) persuade supervisors to give teachers greater flexibility in terms of time devoted to population education; and (b) inform them on the requirements for the effective use of the discovery method;
5. Teachers should be entrusted with more decisions pertaining to discovery activities, such as field trips, to minimize bureaucratic delays;
6. Restrictions on the use of facilities like the library and equipment in science, home economics and art should be eased so students can use them beyond regular office and class hours;
7. On lack of support from administrators, the four groups agreed that teachers should not depend too much on materials coming from the central offices of the media production agencies because these are often inapplicable for local use. Instead, they recommended the following steps to solve the problem of inadequate facilities and lack of teaching aids:
   (a) Administrators should make sure that their school librarians are in the mailing list of producers of population materials;
   (b) A Resource Center of Instructional Reference Center should be set up at the district level to provide population education material and circulate a listing of available materials to the teachers. These resource centers can serve as depots or channels of dissemination of materials for each teacher or each school, and as information links at the local level and between central and district offices;
   (c) A team of teachers should be organized to localize curriculum materials and reproduce different teaching aids on population education to ensure adequate supply of materials and appropriateness of content to the local culture;
   (d) The procedure of distributing curriculum materials should be investigated to avoid delay in the delivery of materials to the local centers;
5. PEP should intensify its program of training teachers to prepare their own teaching aids.

2. The effectiveness of discovery approach also depends to some extent on the compatibility of teaching methods in the mother units into which population education is integrated, with the use of the discovery method.

Policy planners and researchers expressed fears that the use of the traditional expository approach in the mother unit would pose difficulties in the integration of population education (which uses the discovery approach) into the subject. Inconsistency in teaching methods would confuse the students and lessen, if not negate, the effectiveness of the discovery approach.

This group of professionals pointed a source of confusion in the fact that the curriculum guides do not consistently bear out the avowed discovery approach. A cursory content analysis of population education curriculum as integrated in the social studies, reveals an inconsistency between the definition of discovery method and the objectives in some of the learning activities of the students. For instance, the *Overview* portion of the Social Studies curriculum for Grade 2, states: the teacher should "engage pupils in a lot of inquiry activities, of going through the process of stating the problems or asking questions, formulating tentative answers to questions, gathering and organizing data, reporting and interpreting, checking tentative answers, and stating general ideas."

Again, the *Overview* portion of the Social Studies Curriculum for Grade 3 states that "... the questions are sequential and of the high level type which requires reasoning and deliberation instead of mere recital of facts from the pupils." In other words, one of the general objectives stated in the curriculum is to develop the inquiry process among pupils. This general objective seems to go against the following pupil learning activities:

1. "Tell what a population is made of" (Lesson 1, Grade II);
2. "Tell some characteristics of a population" (Lesson 3 Grade III);
3. "Tell which of the two – birth or death – affects population more" (Lesson 3, Grade III);
4. "Tell that a population can change in size" (Lesson 5, Grade II);
5. "Tell the advantageous effects migrants bring to the place they move in" (Lesson 2, Grace IV); and
6. "Tell the relationship of the cause and effect framework of migration" (Lesson 3, Grade IV)

Social studies and mathematics teachers felt that "tell" statements contained in the guides are contrary to the idea of creative discovery.

The policy planners and researchers also questioned the PEP's content outline. They believed it to be heavily topical and runs counter to the basic direction of the curriculum, which is the development of attitudes through discovery approach.

On the other hand, most of the teachers and supervisors did not consider the use of traditional method in mother units a problem in the integration of population education which uses the discovery method.

Furthermore, according to the supervisors, many mother units in which population education has already been integrated have been taught with the use of methods similar to or compatible with the discovery approach. Examples of such methods are the "conceptual approach" in social studies and the "process approach" in science. As for the other subject areas in which the expository method is used, the teachers believed this old method will not affect the teaching of population education. All that is called for, is that teachers are competent and skilled in the use of the discovery approach.

But why do supervisors report that there's a good number of teachers who have undergone population education training but are not integrating the subject matter into the mother unit? The supervisors said this was due partly to the fact that there are separate teaching guides for the unit and population education and partly to the inadequacy of training in the sense that it may not have inculcated in the

teachers the knowledge and ability to integrate population education sub-units into the mother unit.

The policy planners, researchers and the supervisors agreed that the type of integration used by PEP may be the reason some teachers are not able to integrate population education into mother units. They added, however, that considering the administrative constraints under which PEP is working, the present type of integration may be the most convenient and practical for the PEP program which they hoped would only be temporary.

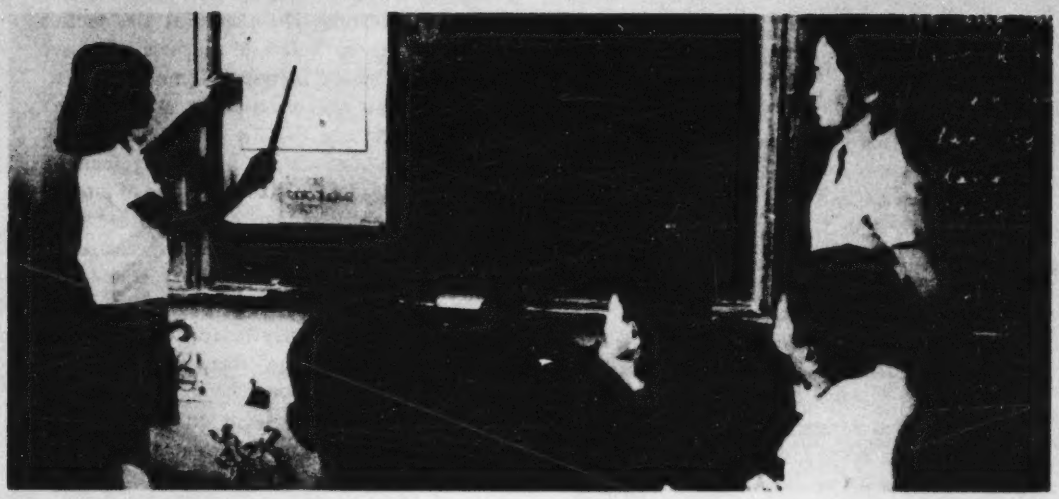
Recommendations to Ensure Effective Integration of Population Education

To reduce the number of teachers who do not integrate population education sub-units into mother units, the following steps were recommended by the teachers, supervisors, policy planners and researchers:

1. The discovery approach should be used in all mother units for consistency of objectives and ease of integration;
2. There should be a conceptual framework for the type of integration that will be used to weave population concepts into mother units;
3. Integration should be effected in subjects other than the present five mother units;
4. The present method of integration, which is characterized by "insertion," should be replaced by continuous permeation or weaving of population concepts along a conceptual framework;
5. Curriculum writers in the central office should be sensitive to, and be kept up to date on, changes in the curriculum materials of mother subjects (which, being often unclear and poorly organized, often need to be revised);
6. Teachers should get better training on how population education sub-units could be made to permeate main topics in the mother syllabus. The policy planners and researchers took note that teachers cannot attain the flexibility in time required by the discovery approach if separate curricula are continuously added to the mother subject. To solve the problem, they recommended that PEP immediately work with Education Development Project Implementing Task Force and the Department of Education's various curriculum centers for the integration of all subject areas – population education, nutrition, drug addiction and environment – into just one curriculum or syllabus for teachers' use. They said that perhaps the Commission on Population and the Population Center Foundation could finance the staff that will undertake the project.
7. Two other issues appear to warrant further research. These are (a) the factors behind the failure of teachers who have been trained in population education to integrate the materials into their mother subject; and (b) the practicality of the integration scheme now being used by PEP. Under the present system of integration, every change in the mother syllabus requires a corresponding change in the population education syllabus to ensure that they complement each other. This practice may be too costly for the program. Perhaps there are other less costly integration schemes which would not be too dependent on specific topics found in the mother syllabus and which would not restrict teachers to specific topic content.

3. The introduction of the bilingual approach (the use of both English and Pilipino in instruction) is another barrier to the effective use of the discovery method.

Both teachers and students have found that the use of English or Pilipino in rural areas where other dialects are spoken minimize discussions and the participation of students in discussion and classroom activities. Teachers



believe students are more comfortable in their own dialects than in either English or Pilipino. The supervisors countered that bilingualism should not inhibit teachers from facilitating discussion. If the teachers feel they could discuss concepts more clearly and effectively in the dialect, then their supervisors should let them use the dialect as an auxiliary language.

The policy planners and researchers agreed that the language barrier is a problem in the effective use of the discovery approach. But they said the need for the use of a common language to establish a national identity is a stronger argument against the use of the dialect as medium of instruction. They said that perhaps the problem could be minimized by translating the curriculum guides into Pilipino, using non-purist terms, or by pairing off English or Pilipino with the local terms.

To help minimize the problems posed by bilingualism to the attainment of free, discovery-oriented discussion in the classroom, the policy planners and researchers recommended the following:

1. Translation of the population education teachers' guides into Pilipino;
2. Use of the non-purist Pilipino translation; and
3. Use by teachers of local terms. This will make the local dialect an auxiliary language to Pilipino or English.
4. Effectiveness of the use of discovery approach depends to some extent on the general culture and social environment of a society.

One policy planner expressed apprehension over the suitability of the discovery approach to Philippine culture. According to him, teaching with the use of the approach basically goes against the Filipino students' cultural orientation. The church, the state and parents provide the answers and the laws – and the students accept them. He said this subservience to authority could jeopardize the successful implementation of the discovery approach because what students discover and learn in the school could be questioned by parents.

In this regard, the policy planners and researchers suggested that research be conducted into the following areas to guide teachers in determining which discovery-oriented approach to use, given certain conditions:

1. If the effectiveness of the discovery approach is dependent on teacher competence, student competence and learning facilities, how effectively has the approach been utilized in the Philippines with these variables taken into consideration? To what extent does the present educational system in terms of teacher competence, student competence, and learning facilities, maximize or minimize the effective use of the discovery approach?
2. What Filipino values and elements of Filipino culture militate against the use of the discovery approach?
3. Which among the discovery-oriented approaches is best suited to Philippine conditions?

SUMMARY

This research monograph reviewed and summarized research results evaluating the effectiveness of the discovery approach as organized into a set of empirically-based propositions, duly guided and qualified by reactions and feedback from the teachers, supervisors, policy planners and researchers gathered from the series of conferences.

This research monograph started with a brief, rather oversimplified review of the process of curriculum development (page 17) and the issues of course objectives (page 17)) and course content (page 18). It then dealt a little more lengthily into the issue of teaching method and set forth justifications for choosing the discovery approach and distinguished among the different variants of the approach (pages 21-23). Then, after enumerating some of the methodological and conceptual difficulties in evaluating the effectiveness of the discovery approach relative to the traditional expository approach (page 24-26), the review set forth six empirically-based propositions as follows:

1. The discovery approach seems to be more effective than the traditional expository approach in bringing about learning, retention, and transfer. And, when different kinds of discovery approaches are compared, the guided discovery approach seems to be more effective than the independent discovery approach (pages 26-30);
2. The discovery approach seems to be more effective than traditional expository approach in stimulating critical thinking, and in so doing, more active student participation in the classroom (pages30-31);
3. The discovery approach seems to be more effective than the traditional expository approach in developing in students a favorable attitude towards the subject matter and towards the teacher (page 32);
4. The effectiveness of the discovery approach depends to some extent on teacher competence: the more competent the teacher, the more likely the discovery approach is to be effective (pages 33-37);
5. The effectiveness of the discovery approach depends to some extent on student competence: the more competent

the student, the more likely he is to learn under the discovery approach than under the traditional approach (pages 38-40). The effectiveness of the discovery approach depends to some extent on how much time is available for instruction (pages 41-42).

Much as we would want to be as consistent as possible with the organization of the original literature review, the fact is that teachers, policy planners, and researchers understandably dealt with the practical issues far more than the theoretical issues. Thus, discussions tended to concentrate more on the last three empirical propositions than on the first three. Moreover, teachers and supervisors also brought up four important factors that could qualify the effectiveness of the discovery approach:

1. The effectiveness of the discovery approach depends to some extent on administrative support: the more support the teacher gets from his supervisors, the more likely the discovery approach is to be effective;
2. The effectiveness of discovery approach depends to some extent on the compatibility of teaching methods in the mother units into which population education is integrated, with the use of the discovery method;
3. The introduction of the bilingual approach – the use of both English and Pilipino in instruction – minimizes the effective use of the discovery approach;
4. The effectiveness of discovery approach depends to some extent on the general culture and social environment of a society.

Each of these propositions and issues were reacted to by teachers, supervisors, policy planners and researchers with agreement, disagreement, or doubt during the conferences. More often than not, their discussions defined and clarified problems of policy and practice. Once discussions took a problem-oriented character, the discussion moved in on either of these two directions: first, the discussions could concentrate on identifying and comparing alternative solutions to the problems presented (program-oriented response); second, the discussions could be devoted to identifying the kind of information practitioners and policy planners would need before they could search for, much less evaluate, possible solutions to the problem (information-seeking response).

Thus at the end of each conference, teachers, supervisors, policy planners and researchers formulated their recommendations and proposals to solve the issues and questions that have been raised during the discussions. The reader will note that the more practical issues which had been dealt with more extensively during the conferences were the ones given corresponding solutions and recommendations by the program professionals. What follows are the consolidated recommendations of the teachers, supervisors, policy planners and researchers on the following issues:

A. *Teacher Competence* – To guarantee teacher competence in the teaching of population education and the effective use of discovery approach, the following recommendations were proposed:

1. Longer and better quality in-service and pre-service training both in population education and the discovery approach to enhance teacher competence should be conducted. If longer practicum sessions in the use of discovery approach cannot be accommodated in the one-week population education training for teachers, a separate training on the discovery method should be organized. The recommended training formats are as follows: (a) Training should emphasize demonstrations and practicum rather than theories; (b) Teaching modules on the various population education topics should be presented in a discovery-oriented manner; and (c) Materials to be used in the training should also be discovery-oriented;
2. Teacher retraining should be included in the PEP plans to upgrade teacher competence and knowledge on some population content which were either not taken up, or were inadequately covered, in the first training given to teachers. The planning of the content and strategy of this retraining should be based on a district-by-district evaluation of the following: (a) the present knowledge level of teachers on population, to find out what topics were sufficiently covered during their first training, what topics need to be

reviewed, and what topics were not included in the first training but are necessary for teaching; (b) the attitude of teachers are actually integrating the population education program effectively and properly into their teaching.

Baseline data on this enable planners of the teacher retraining programs to fit the content and strategy of the training to teachers' needs and interests at the local level. The assumption here is that teacher retraining will be planned and carried out at the district level;

3. Mrs. Remedios Cayari, program officer for curriculum development of PEP said during the policy planners' and researchers' conference that she does not consider the use of the discovery approach in population education problematic. If there are problems arising from the use of the method, these should be tackled in the pre-service training provided by teacher training institutions in various subject disciplines, she said. According to her, the best place to acquire competence in the use of the discovery approach is in a college where a population education is offered as a course. For this reason, the policy planners and researchers recommended that PEP (which provides the population content) tie up with teacher training institutions (which provide training on methodology);
4. Administrators should organize professional groups in schools to help monitor feedback and evaluate the effectiveness of the discovery method in teaching population education;
5. The PEP should regularly provide materials on the effectiveness of the discovery approach from reach and from the experience of teachers in the classroom;
6. Schools should subscribe regularly to professional reading materials containing significant researc findings which will help inform and update teachers on the use of the discovery approach.

It was recommended also during the conferences that the expansion of the training program and the holding of each seminars be temporarily stopped to allow for stocktaking of the following population education training areas:

1. Review the present system of training division-level administrators as trainers on the following questions:
   (a) Are the division-level administrators or supervisors the best trainors on the population education?
   (b) Are middlemen necessary in training teachers or should teachers be trained directly by the central office?
   (c) Is the use of the resource persons from within the locality more effective than the use of resource persons from outside?

2. For planning the content and strategy of teacher retraining, conduct a district-by-district evaluation of the following:
   (a) The present population knowledge of teachers gained from the first training, to find out what necessary population topics have been sufficiently covered, need to be reviewed, or have not been included;
   (b) The attitude of teachers towards population education;
   (c) The modular approach as a better alternative to the present training strategy;
   (d) If the one-week training being given to teachers is sufficient in enabling them to teach population education competently;
   (e) The present strategy of training teachers coming from the same grade levels or subject areas from different schools. According to some supervisors, this strategy does not ensure continuity of training or implementation of population education. As a result, some schools have only primary teachers or only social studies teachers teaching population education. Some supervisors suggested that training should instead be provided to teachers from all grade levels and subject areas in one school, starting with the central school, and then move down to the municipal schools;

3. Conduct a study to determine the extent to which teachers are integrating population concepts into the mother units and identify the factors behind the failure of trained teachers to do this.

The following recommendations were formulated by the program professionals to solve the problem of student competence:

1. Provide slow learners with enough time to

learn by the discovery method;

2. To slow learners, teach easier and fewer concepts, and to fast learners, teach more complex and harder concepts;
3. Slow learners should be taught by guided discovery; fast learners by more independent discovery;
4. Pupils in the lower elementary level should be taught by the guided discovery approach as they are generally unprepared for independent decision-making. For students in the upper elementary, high school and college levels, teachers prescribed the unstructured or independent type of discovery approach. They said students at these levels have already acquired more skills, understanding and insights and therefore can form generalizations better;
5. The teachers further suggested that guided discovery be used in the beginning or the early part of the school year. After the students have more or less learned the process of discovery, they could be taught with the unstructured approach;
6. Tests should be given to students at the beginning of the school year to determine profiles and levels of mental ability. This will help teachers identify the slow and fast learners. The teachers can then program the amount and kind of guidance she will provide to the different students.

B. Flexibility of Time – To ensure that sufficient time is allowed the teachers to use the discovery approach effectively, the teachers recommended that the size of classes and teachers' teaching loads be reduced. This will enable them to give further treatment of population education and the use of the discovery approach.

The supervisors also suggested that teachers should arrange with fellow teachers for an exchange of class periods to achieve continuity in their lessons.

Furthermore, teachers recommended that restrictions on the use of facilities such as the library and equipment in science, home economics and art should be eased so students can use them beyond regular office and class hours.

C. Administrative Support – To gain the support of administrators in the use of discovery approach, the teachers, supervisors, policy planners and researchers recommended the following:

1. With regard to administrative support for outdoor activities, the supervisors suggested that teachers, instead of asking permission from parents and administrators every time a field trip is planned, should ask for this at enrollment time or the start of the school year. This permission should apply to all out-of-school activities during the school year. Also, outdoor activities can be planned in such a way that sites chosen are only about 20 minutes away from the school;

2. Administrators should be retrained so that they will be more open to teachers' suggestions and more responsive to innovation;

3. More regular dialogues should be held between administrators and teachers on the latter's progress and difficulties with the discovery methods;

4. The PEP should (a) persuade supervisors to give teachers greater flexibility in terms of time devoted to population education; and (b) inform them on the requirements for the effective use of the discovery method;

5. Teachers should be entrusted with more decisions pertaining to discovery activities such as field trips, to minimize bureaucratic delays;

6. Restrictions on the use of facilities such as the library and equipment in science, home economics and art should be eased so students can use them beyond regular office and class hours;

7. As far as lack of support from administrators in terms of inadequate facilities and teaching aids is concerned, all of the four groups of population education professionals agreed that teachers should not depend too much on materials coming from the central offices of the media production agencies because these are often inapplicable for local use. Instead, they recommended the following steps to solve the problem of inadequate facilities and lack of teaching aids:

(a) Administrators should make sure that their school librarians are in the mailing list of producers of population material;
(b) A Resource Center or Instructional Reference Center should be set up at the district level to provide population education materials and circulate a listing

of available materials to the teachers. These resource centers can serve as depots or channels of dissemination of materials for each teacher or each school. They can also serve as links of information at the local level and between central and district offices;

(c) A team of teachers should be organized to localize curriculum materials and reproduce different teaching aids on population education to ensure adequate supply of materials and appropriateness of content to the local culture;

(d) The procedure of distributing curriculum materials should be investigated to avoid delay in the delivery of materials to the local centers;

(e) PEP should intensify its program of training teachers to prepare their own teaching aids.

D. Integration of Population Education Sub-Units Into Mother Units – To ensure integration of population education sub-units into mother units, the following steps were recommended by the teachers, supervisors, policy planners and researchers:

1. The discovery approach should be used in all mother units for consistency of objective and ease of integration;
2. There should be a conceptual framework for the type of integration that will be used to weave population concepts into mother units:
3. Integration should be effected in subjects other than the present five mother units;
4. The present method of integration, which is characterized by "insertion," should be replaced by continuous permeation or weaving of population concepts along a conceptual framework;
5. Curriculum writers in the central office should be sensitive to, and be kept up to date on, changes in the curriculum materials of mother subjects (which, being often unclear and poorly organized, often need to be revised);
6. Teachers should get better training on how population education sub-units could be made to permeate main topics in the mother syllabus. The policy planners and researchers took note that teachers cannot attain the flexibility in time required by the discovery approach if separate curricula are continuously added to the mother subject. To solve the problem, they recommended that PEP immediately work with the Education Development Project Implementing Task Force and the Department of Education's various curriculum centers for the integration of all subject areas – population education, nutrition, drug addiction, and environment – into just one curriculum or syllabus for the teachers' use. They said that perhaps the Commission on Population and the Population Center Foundation could finance the staff that will undertake the project;
7. Two other issues appear to warrant further research. These are (a) the factors behind the failure of teachers who have been trained in population education to integrate the materials into their mother subject; and (b) the practicality of the integration scheme now being used by PEP. Under the present system of integration, every change in the mother syllabus requires a corresponding change in the population education syllabus to ensure that they complement each other. This practice may be too costly for the program. Perhaps there are other less costly integration schemes which would not be too dependent on specific topics found in the mother syllabus and which would not restrict teachers to specific topic content.

E. Introduction of Bilingual Approach – To help minimize the problems posed by bilingualism to the attainment of free, discovery-oriented discussion in the classroom, the policy planners and researchers recommended the following:

1. Translation of the population education teachers' guides into Pilipino;
2. Use of the non-purist Pilipino translation;
3. Use by teachers of local terms. This will make the local dialect an auxiliary language to Pilipino or English.

F. Suitability of Discovery Approach in Philippine Culture – To guide teachers in determining which discovery-oriented approach to

use, given certain conditions, the policy planners and researchers suggested that research be conducted in the following areas:

1. If the effectiveness of the discovery approach is dependent on teacher competence, student competence and learning facilities, how effectively has the approach been utilized in the Philippines with these variables taken into consideration? To what extent does the present educational system, in terms of teacher competence, student competence and learning facilities, maximize or minimize the effective use of the discovery approach?
2. What Pilipino values and elements of Filipino culture militate against the use of the discovery approach?
3. Which among the discovery-oriented approaches is best suited to Philippine conditions?

FOOTNOTES

1. Population Education Program, Planning for the Future: Population Education in the Philippines, p. 5, 1973.
2. Dr. Rosario Alberto, Program Officer for Research of PEP, concurs.
3. Robert Veatch, "Ethics, Population Policy and Population Education", Reprint Series, UNESCO, p. 11, 1972.
4. Byron Massialas and Frederick Smith, New Challenges in the Social Studies, 1965.
5. Byron Massialas, Structure and Process of Inquiry into Social Issues in Secondary School, 1970.
6. Robert Veatch, "Ethics Population Policy and Population Education", Reprint Series, UNESCO, p. 11, 1972.

ABSTRACTS

ARMSTRONG, JENNY R.

The Relationship of Mathematics Curriculum Innovation Presented Through Two Methods and Effect upon Achievement as a Function of Learner Ability. *Final report. Wisconsin University, Madison, Office of Education (DHEW), Washington, D.C., Bureau of Research. April 1968.* 92 pages.

Mathematical learning at six cognitive levels, in areas of exact and varied repetition, was studied in 28 educable mentally handicapped students (mean IQ 74, mean age 12.6). Four different machine-presented programs of ten lessons each utilized inductive or deductive modes of presentation and exact or varied forms of curriculum repetition. Results indicated that number learning at the knowledge, application and evaluation levels was better facilitated by an exact form of curriculum repetition. Mathematical learning of operations was equally facilitated by inductive and deductive modes of presentation. Both area and topical curriculum organization were equally effective, regardless of the mode of presentation used; however, exact repetition better facilitated learning at the comprehension level when implemented by the inductive mode, while varied repetition was more effective when implemented deductively.

BUSCH, PHYLLIS

The Use of the "Indoor-outdoor-indoor" Approach to Teaching Science Conservation with Concentration on Methods of Inquiry and Emphasis on Processes of Science, Grades K-3. *Ulster County Board of Cooperative Education Services, New Platz, New York. Sponsoring Agency — Office of Education (DHEW), Washington, D.C., Bureau of Elementary and Secondary Education. 1969.* 27 pages.

Contained are instructional materials developed by a science project to upgrade

conservation education. The lesson plans given are intended to demonstrate the "indoor-outdoor-indoor" approach of teaching science conservation. Concentration is given to methods of inquiry and to processes of science. Four subject areas are treated: Air, water, and weather; Living things; the Earth and its composition; and Overcrowding bodies. One plan is given for each area for each of Grade K-3. The plans list materials required, set problem questions, then describe indoor and outdoor activities to help students discover answers to the questions. Relevant science concepts are listed. The manual also lists the object of "outdoor discovery guides," and give an example guide. There is a summary of the goals of the program, together with general guidelines for teaching and selected references for teachers. This work was prepared under an ESEA Title III contract.

CHAMBERS, DAVID W.

Putting Down the Discovery Learning Hypothesis. *American Educational Research Association. Washington, D.C., North Carolina University, Chapel Hill, School of Dentistry; North Carolina University, Chapel Hill, School of Education. March 1970. Paper presented at the American Educational Research Association Convention, Minneapolis, Minnesota, March 2-6, 1970.* 24 pages.

A laboratory study was performed with four levels of discovery and two levels of an overlearning factor. An improved experimental paradigm was chosen so as to avoid a number of confusions which have obscured previous research. An operational definition was developed for discovery and guided discovery and discovery teaching, and inquiry learning. The results of the study show that overlearning has a considerably more powerful effect on transfer than does discovery. Overlearning seems to be an important condition for the transfer of a discovered principle, not because the principle is apt to be discovered during overlearning but because a certain amount of practice is necessary to make the discovered principle available for transfer.

COLE, HENRY P.

A Interpretation of the "Science – Process Approach" Objectives in Terms of Existing Psychological Theory and Experimentation. *Eastern Regional Institute for Education, Syracuse, New York. May 6, 1966.* 38 pages.

Eastern Regional Institute for Education,

This paper examines the sequence and hierarchy of the (AAAS) "Science – A Process Approach" curriculum. The work of Piaget Bruner forms a framework for an examination of the learning objectives and task in the curriculum. The points of correspondence between AAAS tasks and activities and Piaget's concrete and formal operations are noted for each of the main objectives within each of the eight basic and six integrated processes. Bruner's stages of inactive, ikonic and symbolic reasoning as well as his work on concept and principle learning are used to interpret the psychological basis for AAAS objectives and tasks. The presentation shows that: 1) most objectives and tasks in the basic processes of the curriculum have an empirical basis in psychological research, and 2) many objectives and tasks in the integrated processes have little basis in psychological research.

CONNELLY, MICHAEL F.

Enquiry Materials in Science Teaching. *Ontario Institute for Studies in Education, Toronto November 14, 1969. Paper presented at the Conference of the Science Teaching Association of Ontario (Toronto, Ontario, November 1969).* 27 pages.

Three ways in which the term "inquiry" is used are discussed: inquiry as a teaching

method, inquiry as a mode of learning, and inquiry as a logical disciplinary process. The role of guiding principles of inquiry is analyzed, using a discussion of Harvey's work on the heart to illustrate an inquiry guided by the idea of structure-function. It is argued that guiding principles of inquiry influence problems, facts, hypotheses, interpretations and outcomes. A discussion method is described aimed at teaching an understanding of inquiry. Logic materials which can be used for "inquiry" are listed.

CONNELLY, MICHAEL F.

The Role of Principles of Inquiry in the Conduct of Enquiry and in Curriculum Development. *Toronto, Ontario Institute for Studies in Education. November 14, 1969. Paper presented at the Conference of the Science Teaching Association of Ontario (Toronto, Ontario, November 1969).* 12 pages.

The relationship of various guiding principles of inquiry to the "topics" of inquiry, problems, facts, hypothesis, interpretations, and conclusions or outcomes are analyzed. The idea of structure-function is given as an example of a guiding principle in biological inquiry. Homoestasis is another. It is argued that the guiding principle used determines how the subject matter is analyzed, so that problems, facts, hypothesis, interpretations and outcomes will be seen differently and will relate to each other in different ways under different guiding principles. The implications of this analysis for curriculum development are discussed. (EB).

CRONBACK, LEE

Research Conference on "Learning by Discovery". *Stanford University, California. January 1974.* 14 pages.

A two-day research conference on "Learning by Discovery" was held to 1) clarify some of the issues involved in learning by discovery, 2) review what is known on the subject, and 3) suggest ways of extending knowledge about it. The 25 participants were representatives from the fields of psychology and education. Observers from government agencies were also invited. At the first session, two very different viewpoints were presented to clarify some of the issues. The second session was concerned largely with a critical review of previous work in the field, the third with curriculum projects, the fourth with problem solving and personality variables, and the fifth with summary statements and general discussion. The conference appeared to bring the complexity of the problem into focus. The very phrase "learning by discovery" seemed to have a variety of meanings. Research which grew out of the conference was analyzed and discussed for the first time. Suggestions were made on ways by which the discovery process may be guided and research questions posed.

CRUZ DE LA, IMELDA R.

A Description of the Constitution of a Unit of Programmed Instructional Material and its Use for the Teaching of Multiplication Concepts for Grade 2. *Master's thesis, Ateneo de Manila. 1973.*

Instructional materials were prepared and pre-tested to a group of 10 randomly selected Grade 2 boys before these materials were given to four groups of boys in the same grade, matched more or less as to their background on modern mathematics and average reading ability of 2.1 to 5.0. Statistical t-test of significance as given by A.C. Crocker was used to validate the programmed materials. To supplement this, students' error rate was measured. A descriptive survey-investigation (as described by Carter V. Good) using documentary analysis was also utilized for the evaluation of the instructional materials. Analysis showed that: (1) programmed instructional materials in mathematics are

feasible in Grade 2 level, (2) the teaching of particular concepts and skills in mathematics for the elementary level can be programmed, and (3) programmed material is self-instructional. The study then recommends that: (1) schools make use of programmed instructional materials to heighten pupils' motivation to effective learning and to supplement the teaching of elementary math in the Philippines, (2) schools provide in-service training for all teachers on the basic principles of programming so that they can make small attempts to program the subject matter they teach, (3) schools continue to experiment and to revise the program prepared in the study.

GLASER, ROBERT

Variables in Discovery Learning. *Pittsburgh University, Pa.; Learning Research and Development Center.* 1966. 20 pages.

A presentation was made of the analysis of behavior that is required as a first step in the process of developing procedures and materials for "discovery learning." Teaching by the discovery method is described as requiring that a minimum or structured instructional sequences be imposed to allow a child to 1) learn by discovery and 2) learn to discover. The kinds of sequences that could be used were grouped as: 1) inductive sequences, in which a rule is presented before the example is given; and 2) trial-and-error learning sequences, which would require that students discover things for themselves. The incompatibility between this self-discovery process and error minimization was also discussed. Conclusions were 1) "learning by discovery" appears to involve not only the properties of induction and errorful learning, but also interactive effects with task properties, and 2) interesting leads for studying "learning-to-discover" may be found in operant analysis, cognitive simulation, and studies of exploratory drive.

GUTHRIE, JOHN T.

Expository Instruction Versus Discovery Method. *(Journal of Educational Psychology 35).* (1): 45-49.

To test the proposition that learning facilitates retention and transfer, 72 college students were taught to decipher cryptograms with four instructional sequences: rule-example, example-rule, and example. A no-training control group was included. On the retention test, the rule-example group was superior to all groups. The other groups did not differ. On the remote transfer test, the example group was superior to all others, the example-rule and no-training groups did not differ, and the rule-example group was inferior to the others. All differences were significant at the .05 level. The discovery method appears to facilitate transfer, but not retention; expository instruction facilitates retention, but impedes remote transfer.

MASSIALAS, BYRON C., and others

Structure and Process of Inquiry into Social Issues in Secondary Schools. *Vol. 1 Inquiry into social issues. Michigan University, Ann Arbor.* April 1970. 319 pages.

To determine the status of social issues instruction in secondary schools and to develop a category system which enables both teachers and researchers to analyze verbal interaction on social issues, 60 secondary schools in Michigan were randomly selected and all biology, English and social studies teachers in 58 of these schools were surveyed. The instrument used was the Michigan Social Issues Teacher Questionnaire (MSITQ). Status of social issues instruction was measured by (1) number of issues discussed, (2) time spent discussing these issues, (3) kinds of topics discussed, and (4) materials used. The relationship of these factors with certain demographic and attitudinal

characteristics of teachers were explored. The findings were: (1) Most teachers spent little time discussing social issues. (2) Those who spent more time discussing social issues were likely to be male, social studies teachers with 4-5 years teaching experience, who had higher belief in student expression and lower belief in traditional socio-political values (BSTV). (3) In contrasting high and low BSTV groups, it was found that the former had difficulty separating opinion from fact. A second part of the study consisted of selecting a smaller group of social studies teachers who spent at least 25 per cent of classroom time for discussions of social issues and who were willing to participate further in the study. Actual discourse in their classrooms was recorded and analyzed, using the Michigan Social Issues Cognitive Category System (MSICCS). The MSICCS is an observation instrument for classifying verbal interaction in the classroom. It focuses on cognitive operations such as definition and clarification, hypothesis formation or position-taking, and grounding, and investigates such classroom components as student participation behavior, teacher dominative influence and cognitive interaction, both traditional or inquiry. Analysis or resulting patterns showed that teachers did not measure up to the inquiry model, and that student participation did not provide sufficient information on quality of discourse.

MASSIALAS, BYRON C., and others

Structure and Process of Inquiry into Social Issues in Secondary Schools. Vol. III *Social issues classroom discourse: a study of expository, inquiry-nonprobing, and inquiry-probing classes. Michigan University, Ann Arbor.*

This study evaluated teaching effectiveness in terms of the cognitive and critical thinking skills of participating students and their attitudes towards teacher and class. Initial analysis of audio-taped classroom sessions seemed to show the existence of these distinct discussion styles: (1) Expository – Sharing background information only, (2) Inquiry-nonprobing – Giving hypothesis, opinions and taking positions only, (3) Inquiry-probing – Development ideas as well as giving a good amount of time to defining, clarifying, evidencing or testing these ideas. The instruments used for determining critical thinking were the Michigan Social Issues Cognitive Category System and the Harvard Social Issues Analysis Test. Student attitudes were measured by the Minnesota Student Attitude Inventory. Findings were that students in inquiry-probing classes rated highest and did very well on the critical thinking test. Expository classes came next. The study also found that (1) Indirect teacher influence does not lead consistently to inquiry discussions, (2) Teacher inquiry questions are instrumental in promoting and sustaining inquiry discourse, (3) Students in inquiry classes are more deeply involved in class discussion than students in expository classes, and (4) Students in inquiry classes usually spontaneously support the position they take.

RAMON, HERMINIA CRUZ

Discovery-centered vs. Teacher-centered Patterns of Instruction: Changes in Critical Thinking. *Master's thesis, University of the Philippines.* 1971.

Thirty pairs of boys and girls were matched as to chronological age, mental and reading abilities, and socio-economic levels and were taught by one teacher who used the discovery-centered method of teaching for the experimental group and the teacher-centered method for the control group. A pre-test in critical thinking, patterned after the Watson-Glacer Critical Thinking Appraisal from YM, was first given to both sample groups at the beginning of classes. The same test, given four months later, was designed to measure the

application of some of the more important component abilities of critical thinking: inference, recognition of assumptions, deductions, interpretation, and evaluation of arguments. Test results indicated that the critical thinking skills of pupils in the experimental group increased significantly while those in the control group did not. Pupils under the discovery-centered approach consistently improved significantly in four of the five component skills measured by the critical thinking test. One skill, however, unaffected by the pattern of instruction was the ability of both groups of pupils to evaluate arguments. Under the discovery-centered approach, pupils revealed a marked change in their ability to make inferences. These results seemed to support Bruner's hypothesis that cognitive skills can be coaxed into being in the earliest periods of life provided the means are brought to the level of the pupils. It was therefore suggested that the development of critical thinking be given its rightful place in the elementary science curriculum so that strengthened and strengthening skills could serve as basis for continuing growth in cognitive development at the higher levels of science instruction.

ROUGHEAD, WILLIAM G., and SCANDURA, JOSEPH M.

What is Learned in Mathematical Discovery. *Journal of Educational Psychology, 35 (4): 283-289.* July 28, 1967.

Two questions were asked: (1) Can "what is learned" in mathematical discovery be identified and taught by exposition with equivalent results, and (2) How does "what is learned" depend on prior learning and on the nature of discovery? The major hypothesis was that discovery subjects may discover derivation rules for obtaining classes of solutions only when the solutions are not initially known. Four programs, (specific) rule-given (R), discovery (D), guided discovery (G), and exposition of derivation rule (E) were administered to 105 junior and senior college students, grouped into seven. One group received program R alone; the others received R with one of the other programs. Both orders of presentation were represented: RD, DR; RG, GR; RE, ER. All the subjects were required to derive new solutions within the scope of the derivation rule. As hypothesized, Groups R and RD performed at one level which was reliable. Theoretical and practical implications were discussed.

SALAMANCA, PERFECTO P.

The Process Approach of Teaching Science in Grade 4 in the Division of City Schools, Manila: a Critical Study. *Master's thesis, University of Santo Tomas.* 1973.

To determine the effectiveness of the process approach in teaching science to Grade 4 students in the Division of City Schools, a survey designed to reflect the opinions and reactions of science teachers and supervisors towards the use of this approach was undertaken. One hundred sixty science teachers and 58 supervisors were interviewed through a constructed questionnaire. Other research methods were employed to cross validate the data gathered from the survey. Observations of science classes were conducted to investigate and evaluate the prevailing conditions and factors affecting the teaching of science in the 4th grade. A critical review of science instructional materials, teaching techniques and procedures, and learning experiences were also done. Survey results showed the process approach was effective. However, observations of the science classes disclosed some problematic areas in teaching science through this approach. Instructional material for self-discovery study by the pupils as well as a comprehensive evaluative program for their growth were not adequately provided for by the school. There were not enough laboratory rooms and not enough funds to purchase

up-to-date science books, references, supplies and equipment. Not all of the teachers and supervisors in charge of science instruction were prepared to use and supervise the approach. For these problems, the study recommended the following solutions: (1) Appropriate more funds for the construction of laboratory rooms and the purchase of instructional materials, supplies and equipment. (2) Conduct in-service training on the process approach. (3) Conduct a study to formulate varied evaluative techniques and instruments for measuring the effectiveness of the process approach in relation to behavioral objectives.

SOWDER, LARRY

Discovery Learning: A Status Study, Grades 4-7, and an Examination of the Influence of Verbalizing Mode on Retention. *ERIC, Ateneo de Manila University, Population Center Foundation* July 1969. 154 pages.

The study had two aims: to explore the ability of Grades 4-7 pupils to generalize selected numerical situations (by giving short-cut formulas or secret-rule items) and to study how verbalization of the generalized numerical situations affects the retentive ability of the pupils. Eighteen pupils from each of Grades 4-7 in a public school were randomly chosen and given an individually administered discovery test. The test consisted of showing numerical expressions in a number of instances and recording the number of instances at which the correct generalizations were formed. Performance on a follow-up test given a week later, based on instances of generalizations on the discovery test, provided information on the influence-of-verbalizing study. Results indicated that most pupils can make generalizations of the type encountered, although lower ability pupils do so at a slower rate. The range of numerical instances that could be given is three to 6, and the optimal grade level at which to offer generalizing tasks is Grade 6 or after. The plateau on Grade 6 supports Piagetian thought although it may also be due to a plateau on computational proficiency – higher grade level has higher computation achievement. The influence of verbalization after generalization gave scanty evidence and therefore invites further study.

SUGRUE, MARY A. SHEA

Structure and Process of Inquiry Into Social Issues in Secondary Schools. Vol. II *A study of teacher-student attitude-congruence patterns and student evaluations of controversial social issues classes and teachers. Michigan University, Ann Arbor.* 1970. 339 pages.

This study investigated student reactions toward social issues instruction itself, and the effects of various demographic and attitudinal or perceptual characteristics on these reactions. The research instrument used was the Michigan Social Issues Student Questionnaire (MSISQ). Student perception of social issues teaching was measured by: (1) general appreciation of teacher and class, (2) purposiveness of class, (3) critical thinking of class, and (4) maintenance climate of class. The variables which were investigated as possibly having some influence on these factors were demographic and attitudinal characteristics of teachers, students, and class; attitudinal characteristics of teachers and students regarding classroom instruction in general; perceptions of teachers and students of actual classroom occurrence; attitudes of teachers and students regarding issues; and congruence. Teacher-class characteristics related primarily to student perceptions of the order, purpose and disciplinary climate of class. Majority of significant teacher-class variables were demographic: sex, marital status, urban-rural-suburban class, public-nonpublic school. The teacher's perception of his role as moderator tended to result in positive student evaluation. Student variables related more to general appreciation and critical thinking.

Significant demographic characteristics were sex, parental occupation, and grade-point average. Significant perceptual/attitudinal variables were belief in student expression, belief in traditional socio-political values, teacher stance in issues discussed, number of issues perceived as objectional and perception of immaturity as reason for non-discussion. The data showed that congruence patterns seemed to have no influence on student evaluations. This suggests that teachers can include social issues instruction without very great worry about disaffecting students even where wide attitudinal and perceptual differences exist. Generally, the study showed that students returned favorable evaluations of social issues classes and teachers in all four measured areas.

WITTROCK, M.C.

Verbal Stimuli in Concept Formation: Learning by Discovery. *Journal of Educational Psychology 54 (4):* 183-190. 1963.

Two hundred ninety-two college students were taught by one of four treatments to decipher transposition codes. The treatments were: rule and answer given; rule given, answer not given; rule not given, answer given; and rule and answer not given. A two-by-two linear hypothesis design was used to analyze the results. It was hypothesized and verified that when retention and transfer to several examples are the criteria, giving rules is more effective than not giving rules. An "intermediate" amount of direction produced the greatest retention and transfer, but a "maximum" amount of direction produced the greatest initial learning. The "minimum" direction group was least effective on initial learning, retention, and transfer. It was concluded that under certain conditions, practice and reinforcement for guided development of concepts can effect retention and transfer.

YOUNGS, RICHARD C.

The Nurturance of Independence and of Independent Learning in Fourth Grade Children Through Inquiry Development, Final Report. *Illinois State University, Normal. Melcalf Lab. School. Sponsoring agency Illinois State University, Normal, Nov.* 11967. 59 pages.

A set of instructional materials and methods, designated as the Inquiry Development Program, was designed to teach children to learn independently. The student was presented with an event which had an outcome that ran counter to his expectations. Motivated by curiosity, he searched for an explanation to the discrepancy between what he expected and the actual event. Several avenues of inquiry were offered to assist him in his investigations. To test the program, 71 fourth grade students were divided into three groups - one control and two experimental. The experimental groups used the Inquiry Development Program in addition to their regular curriculum. Pre-tests and post-tests were administered to determine the levels of achievement, responsibility, and academic achievement in science. A test to measure the level of inquiry was administered afterwards. The results of the tests for independence and academic achievement were compared through an analysis of covariance. The test for inquiry was analyzed by a one-way analysis of variance. The only significant difference noted was that the students of the experimental group offered more explanations to a problem situation than did those of the control group.

ABOUT THE AUTHOR:

Carmelita L. Villanueva is director of the Population Education Research Utilization project of the information division of the Population Center Foundation. She is a candidate for an M.A. in Communications from the Ateneo de Manila University. She finished her A.B. in journalism at the University of the Philippines in 1969.

POPULATION CENTER FOUNDATION

Established to serve as a resource institution for population and family planning activities in the private and public sectors.

The POPULATION CENTER FOUNDATION (PCF) is a private grant-making institution set up in 1973 to increase the involvement of the private sector in the country's effort to bring about timely and effective solutions to its population problem.

To support and complement the National Population Program, the Foundation stimulates alternative means towards national population goals; supports the development of new schemes that more fully integrate population with such fields as nutrition, human settlements, environment, and social welfare; and secures the increasing participation of the private sector in all these areas. Toward these ends it has developed four major programs: Program of Assistance to Innovative Projects, aimed primarily at enhancing the efficiency and effectiveness of present population program activities; Information and Research Utilization Program, aimed at upgrading the competence of the personnel implementing population activities; Technical Assistance Program, aimed at strengthening the institutions implementing population program activities; and Research Program, aimed at expanding the knowledge base needed to upgrade performance, individual competence, and institutional capabilities.

BOARD OF TRUSTEES

Imelda Romualdez Marcos
Founding Chairman

Onofre D. Corpuz
Vice Chairman

Estefania Aldaba-Lim
President

Carlos Palanca
Treasurer

Tomas Aguirre
Assistant Treasurer

Jose Y. Campos
Member

Vincent Recto
Member

Ernesto Escaler
Member

Conrado LL Lorenzo, Jr.
Secretary to the Board
and Executive Director